those indicated by red arrows based on ravine

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MONTHLY WEATHER REVIEW

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CONTENTS

Persistency of Rain and Snowfall Periods During the Winter at San Francisco [illegible] ..... [illegible]

Meteorological and Climatological Data:
Aerological Observations ..... [illegible]
River Stages and Floods ..... [illegible]
Climatological Data ..... [illegible]
Severe Storms ..... [illegible]

Solar Radiation Data:
Solar Radiation Observations ..... Page 222

Charts I-XII

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PERSISTENCY OF RAIN AND NO-RAIN PERIODS DURING THE WINTER AT SAN FRANCISCO

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ABSTRACT

A 20-year record of winter precipitation data for San Francisco is used to determine frequencies of periods of rain and no-rain of various lengths and the frequencies of periods of a given type of weather followed by the same type of weather. The observed frequencies are compared with those expected on chance and are examined for evidence of persistence of rain and no-rain. The use of persistency as a forecasting aid is discussed and its skill determined.

INTRODUCTION

The Northeast Pacific with its great expanse of water surface has been found to be especially well suited for the development of forecasting methods based on weather map types. The relatively uniform north-south temperature gradient of the ocean surface and the lack of orographic influences do not lead to abrupt changes in the circulation patterns. Air masses moving into the area from the continental source regions adjacent to the Pacific Ocean have undergone considerable modification before becoming involved in the existing major air streams. The same considerations which have led to successful weather map typing for the area lend themselves to a study of persistence. Accordingly, it was felt that a study of persistency of weather at San Francisco held promise of worthwhile results.

PROBLEM

The weather along the Pacific coast in the vicinity of San Francisco is controlled to a large extent by the position, shape, and intensity of the Eastern Pacific subtropical High, and to a lesser extent by the location and intensity of the Aleutian Low. Forecasting studies for the west coast have recognized the Pacific High as the predominant controlling feature of the surface map. Vernon [1] in his study of winter precipitation at San Francisco based on map types found that the most important considerations were the position of highest pressure off the California coast in determining the probability of rain during a Westerly Type and the shape of the high and its east-west displacement leading to the Northerly or Southerly Type classification. In the Westerly Type the High acts usually as a barrier to storms approaching the central Pacific coast, but if the center of the High is sufficiently far south such storms may approach the coast in the vicinity of San Francisco. In the Northerly Type, the High acts as a steering mechanism to bring Lows forming in the Gulf of Alaska southward along the Pacific coast; in the Southerly Type, storms forming in the Central Pacific are carried northward. During the relatively infrequent instances of a storm approaching from the east, the Pacific High again acts in its steering capacity.

Forecasters have long recognized the Eastern Pacific High as a persistent phenomenon. While acting as a control to the surface features, it is in turn probably controlled by air streams prevailing at middle and upper levels in the atmosphere. If the forecaster accepts this viewpoint, he is faced with the problem, except for variations of the pressure distribution as a result of migrating ridges, of forecasting surface changes which are due to causes only partially known and of such nature that data describing them are unavailable. When confronted with this situation, the forecaster generally tends to fall back on the known persistency of the main features of the weather map and to continue forecasting the current weather trend. With the exception of the study of the persistency of weather at several European stations by Newnham in 1916 [2] and Besson in 1924 [3], and at a station in the central United States by Blair in 1924 [4], very little information is available in a satisfactory form to enable the forecaster to use day-to-day persistency in other than a subjective manner. Blumenstock [5], in his analysis of drought by means of the theory of probability, has made a general study of the probability of occurrence

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of periods with little or no precipitation over most of the United States, but the study does not lend itself for use by the forecaster. The recent emphasis placed on the objectivity of forecasting methods brings to light the importance of determining (1) the degree to which persistency resulting from broadscale flow patterns enters into the forecasting problem, and (2) the way in which it contributes to the indicated skill of an objective method. The purpose of this paper is to present the results of a study of these two aspects of persistency of rain and no-rain periods at San Francisco.

PROCEDURE

For the purposes of the study persistency was defined as follows: Persistency is the observed percentage frequency in excess of chance that a period of M days of a given type of weather is followed by N or more consecutive days of the same type of weather beginning L days later. (In this definition a period is taken as beginning with the last change in the weather type.)

The period chosen for the study includes the months December through March for the 20 years 1927–47. The daily weather record for San Francisco published in the "Climatological Data" for California was used to type each day as either a rain or a no-rain day. A day receiving a measurable amount of rain was considered to be a rain day. As an initial step in the study, the frequencies of periods of rain and no-rain of various lengths were determined. Next, from these data, the frequencies of periods of various lengths of rain and no-rain followed by one or more days, two or more days, etc., of the same type of weather were determined. Through a further consideration of the record, frequencies of recurrence of a given type of weather on the first, second, and third days following periods of various lengths were obtained.

During the 80 months (December through March) of the 20-year record considered, 819 rain days occurred out of a total of 2,425 days, thus giving 33.8 percent rain days. For determining the probability on chance of rain occurring on any one day a ratio of ⅓ was used. On this basis, the probability of a rain period continuing unbroken for 1 day is ⅓, for 2 days ⅑, for 3 days $\frac{1}{27}$, etc. Similarly, the probability on chance that a no-rain period will continue for one more day is ⅔, for two more days ⅔, for three more days $\frac{2}{27}$, etc.

In counting the periods of rain and no-rain during the winter season, the periods at the beginning and end of the season were arbitrarily assigned to that month in which the greatest number of days fell. For this reason the total number of days involved in a portion of the study differs slightly from the total number recorded during the months of the 20 years considered.

FREQUENCY OF PERIODS OF RAIN AND NO-RAIN

The results obtained from the tabulation of the frequencies of rain periods of various lengths are shown in table 1. Also shown in this table are the frequencies of the periods of various lengths expected on a chance distribution of the rain days and the cumulative totals of the observed rain periods from the longest to the shortest.

The calculation of the frequency of periods of various lengths expected on chance requires the solution of the problem of runs for two types of weather. Cochran [6] gives the equation

$$f_{r,m}=p^r q[2+q(m-r-1)] \qquad (1)$$

where $f_{r,m}$ is the frequency of runs of length r out of m trials, for the type of weather having p as the probability of occurrence during the unit period, $q=1-p$ and $1\leq r\leq(m-1)$. This equation was used in obtaining the frequencies of rain periods of various lengths with $p=⅓$, $q=⅔$, and $m=121.3$, the average number of days per season. Since 20 years of record were used, the frequencies thus obtained were multiplied by 20.

The observed total number of rain periods of different lengths (table 1) indicates an apparent tendency for rain to persist for about 5 days, as shown by the fact that the number of periods lasting 5 days actually exceeded the number lasting 4 days. The occurrence of periods lasting 1 and 2 days was less frequent than that expected on chance, and the number lasting longer than 3 days was in general more frequent than expected on chance. The average number of rain periods per month was 3.84. In the 307 rain periods considered during the 20 years of record, 810 days of rain were involved giving an average length for the rain periods of 2.64 days. The longest rain period was 19 days.

Data for the no-rain periods are given in table 2. Equation (1) with p and q interchanged was used to calculate the number of runs of various lengths expected on chance. The frequency of observed no-rain periods increases from 7 periods lasting 8 and 9 days to 12 periods lasting 10 days and 11 periods lasting 11 days and thus indicates an apparent tendency for the no-rain periods to persist about 10 days. The average number of no-rain periods per month was 3.89. The small difference compared to the rain periods is due to the fact that there tended to be a higher ratio of no-rain to rain periods at the beginnings and ends of the seasons. In the 311 no-rain periods considered, 1,618 no-rain days were involved, giving 5.20 days as the average length of the no-rain periods. The periods lasting from 1 to 9 days were considerably less frequent than would be expected on chance,

TABLE 1.—*Observed frequency of rain periods by duration in days, frequency of rain periods of various lengths expected on chance, and frequency of rain periods cumulated from the longest to shortest (20 seasons, 1927–47)*

	Length of rain periods in days																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
December	33	15	9	5	8	2				2		1		1					
January	28	16	14	3	7	5	1	3											
February	34	25	8	4	3	2	2	2							1				1
March	33	14	7	8	3	3	2	2											
Observed total	128	70	38	20	21	12	5	7	0	2	0	1	0	1	1	0	0	0	1
Frequency expected on chance	362.4	119.8	39.6	13.1	4.3	1.4	0.47	0.16	0.05	0.02	0.01	<.01	<.01						
Observed cumulative total (reverse)	307	179	109	71	51	30	18	13	6	6	4	4	3	3	2	1	1	1	1

TABLE 2.—*Observed frequency of no-rain periods by duration in days, frequency of no-rain periods of various lengths expected on chance, and frequency of no-rain periods cumulated from the longest to shortest (20 seasons, 1927–47)*

	Length of no-rain periods in days																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
December	27	11	8	6	----	2	5	2	2	5	1	4	1	----	3	1	1	1	----	----	----	----	----	----	----	----	1	1	----	----
January	22	11	10	6	3	3	4	3	1	3	5	2	1	----	1	----	----	----	----	1	1	----	----	----	1	----	----	----	----	----
February	19	16	12	9	3	4	2	1	2	1	1	----	2	----	----	1	1	----	1	1	1	1	----	----	----	----	----	----	----	----
March	18	13	7	6	7	2	3	1	2	3	4	1	1	----	----	1	----	----	----	----	----	----	1	----	----	----	----	1	1	1
Observed total	86	51	37	27	13	11	14	7	7	12	11	7	5	0	4	3	2	1	1	2	2	1	1	0	1	0	1	2	1	1
Frequency expected on chance	185.6	122.8	81.2	53.7	35.5	23.5	15.5	10.3	6.8	4.5	3.0	2.0	1.3	.85	.56	.37	.25	.16	.11	.07	.05	.03	.02	.01	<.01	<.01	----	----	----	----
Observed cumulative total (reverse)	311	225	174	137	110	97	86	72	65	58	46	35	28	23	23	19	16	14	13	12	10	8	7	6	6	5	5	4	2	1

and the periods longer than 9 days were on an average much more frequent. The longest period without rain recorded was 30 days.

A further consideration of equation (1) shows that for commonly observed values of p and q, and $m \gg r+1$, the ratio of the no-rain to the rain periods expected on chance approaches the geometric progression:

$$\frac{\text{frequency of no-rain periods of length } r}{\text{frequency of rain periods of length } r} = \left(\frac{q}{p}\right)^{r-2} \qquad (2)$$

As previously indicated for this study, $p=\frac{1}{3}$, and $q=\frac{2}{3}$; thus,

$$\left(\frac{q}{p}\right)^{r-2} = (2)^{r-2}$$

A comparison of the ratios expected on chance and those actually observed is shown in table 3. The ratios expected on chance increase much more rapidly than the observed ratios. Since the exponent of equation (2) is zero for $r=2$, this indicates that on a chance basis the frequency of periods of no-rain lasting 2 days is the same as the frequency of rain periods of the same length regardless of the climatological expectancy (within, of course, the limits of p and q for which the approximate relation (2) is valid). A comparison of the observed and expected ratios for this value of r shows that this condition is not attained by the actual data.

TABLE 3.—*Ratios of frequency of no-rain periods to frequency of rain periods expected on chance compared with observed ratios*

Days in period (r)	1	2	3	4	5	6	7	8	9	10	11
Ratios expected on chance	0.5	1	2	4	8	16	32	64	128	256	512
Observed ratios	0.67	0.73	0.97	1.4	0.62	0.92	2.8	1.0	-----	(6.0)	----

FREQUENCY OF RAIN AND NO-RAIN PERIODS FOLLOWED BY THE SAME TYPE OF WEATHER

From the accumulated values obtained from tables 1 and 2, the percentage of times a period of a given type of weather (rain or no-rain) is followed by the same type of weather may be calculated. From table 1, for example, out of the 307 cases of a rain period of at least 1 day duration, 179 cases, or 58 percent, were of at least 2 days duration; 109 cases, or 36 percent, were of at least 3 days duration; etc. Of the 179 cases lasting 2 days or more, 109, or 61 percent, lasted at least 3 days; 71 cases, or 40 percent, lasted at least 4 days; etc. Corresponding frequencies were obtained in a similar manner for the no-rain periods. Data obtained in this manner were plotted for rain periods and no-rain periods, and lines of equal percentage frequencies were drawn (figs. 1 and 2). Percentage frequencies of a rain period or no-rain period continuing for 1, 2, . . . days on a chance basis were entered at the tops of the respective graphs.

Figures 1 and 2 show that the probability that existing weather at San Francisco will recur is considerably greater than would be expected by chance. The greatest probability of a rain period continuing for at least one more day is attained following a rain period of 4 days duration with a value of 72 percent as compared to 33 percent expected on chance. The greatest probability of rain continuing for at least two more days occurs following a rain period of 3 days. The probability here is 47 percent compared to 11 percent expected on chance. Figure 2

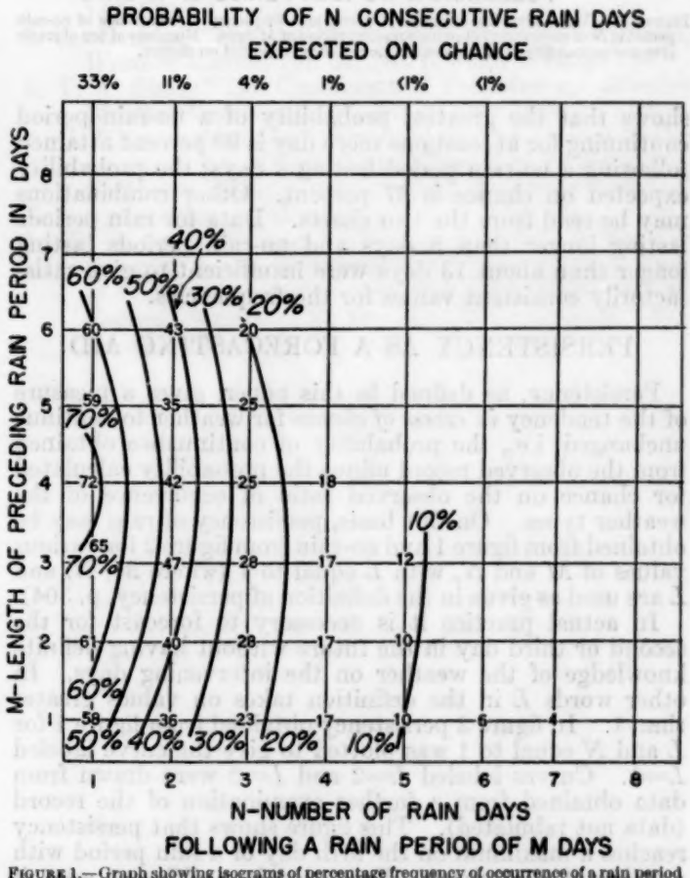

FIGURE 1.—Graph showing isograms of percentage frequency of occurrence of a rain period of N or more days following a rain period of M days. Numbers at top of graph give the probability of N consecutive rain days expected on chance.

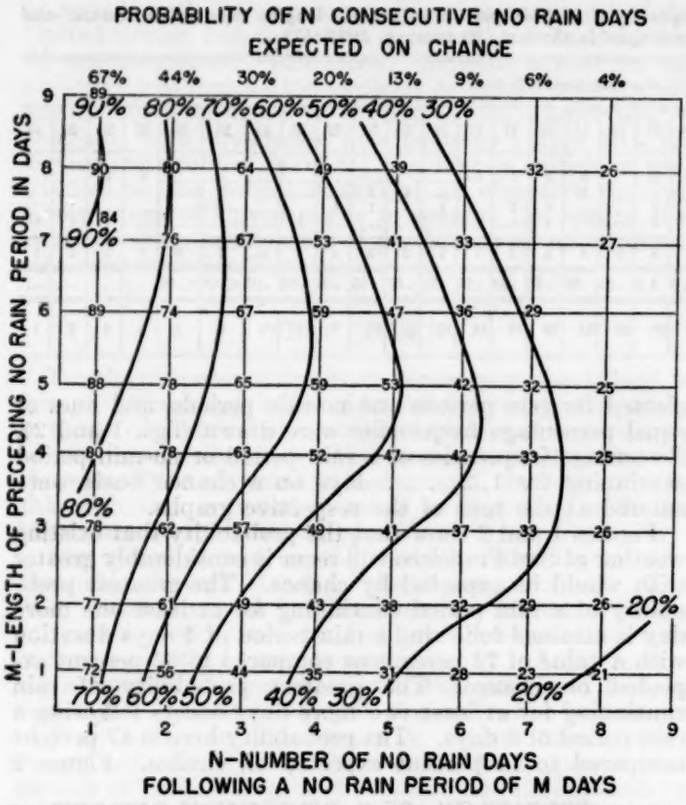
PROBABILITY OF N CONSECUTIVE NO RAIN DAYS
EXPECTED ON CHANCE
67% 44% 30% 20% 13% 9% 6% 4%
90% 80% 70% 60% 50% 40% 30%
M-LENGTH OF PRECEDING NO RAIN PERIOD IN DAYS
N-NUMBER OF NO RAIN DAYS
FOLLOWING A NO RAIN PERIOD OF M DAYS

FIGURE 2.—Graph showing isograms of percentage frequency of occurrence of no-rain period of N or more days following a no-rain period of M days. Numbers at top of graph give the probability of N consecutive no-rain days expected on chance.

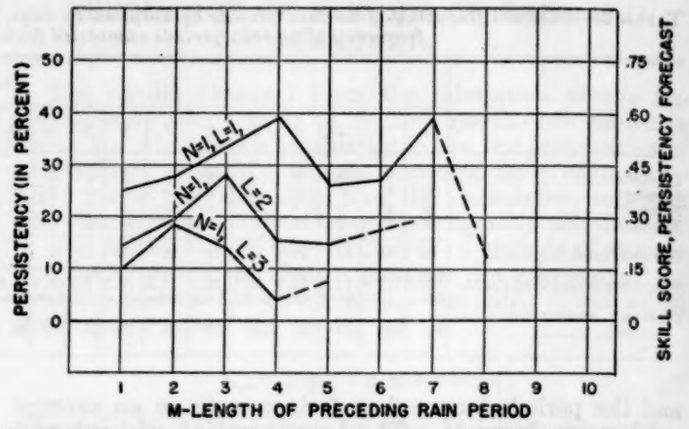

FIGURE 3.—Graph showing persistency of rain on first, second, and third days (L=1, 2, 3) following a rain period of M days and corresponding skill score of a persistency forecast.

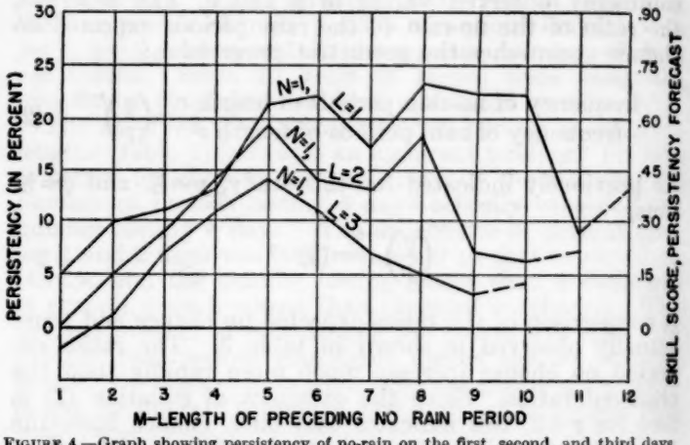

FIGURE 4.—Graph showing persistency of no-rain on the first, second, and third days (L=1, 2, 3) following a no-rain period of M days and corresponding skill score of a persistency forecast.

shows that the greatest probability of a no-rain period continuing for at least one more day is 90 percent attained following a no-rain period lasting 8 days; the probability expected on chance is 67 percent. Other combinations may be read from the two charts. Data for rain periods lasting longer than 8 days and no-rain periods lasting longer than about 13 days were insufficient to give satisfactorily consistent values for the frequencies.

PERSISTENCY AS A FORECASTING AID

Persistency, as defined in this paper, gives a measure of the tendency *in excess of chance* for weather to continue unchanged, i.e., the probability of continuance obtained from the observed record minus the probability calculated for chance on the observed ratio of occurrence of the weather types. On this basis, persistency of rain may be obtained from figure 1 and no-rain from figure 2 for various values of M and N, with L equal to 1 (where M, N, and L are used as given in the definition of persistency, p. 304).

In actual practice it is necessary to forecast for the second or third day in the future without having definite knowledge of the weather on the intervening days. In other words L in the definition takes on values greater than 1. In figure 3 persistency obtained from figure 1 for L and N equal to 1 was plotted to give the curve labeled L=1. Curves labeled L=2 and L=3 were drawn from data obtained from a further examination of the record (data not tabulated). This figure shows that persistency reaches a maximum on the fifth day of a rain period with a value of 39 percent. Expressed in a different way, if "today" is the fourth day of a rain period the over-all probability that it will rain "tomorrow" is 72 percent (from fig. 1), which, when reduced by the 33 percent probability that it will rain "tomorrow" due to chance, gives 39 percent for the value of persistency. Under the same conditions, i. e., rain during the last 4 days, the probability that it will rain "the day after tomorrow," without considering the weather "tomorrow," is 48 percent as obtained from a study of the record. Reducing this figure again by 33 percent, the probability of rain due to chance, gives 15 percent, which is the value read from the curve labeled L=2 in the figure. Persistency existing for other situations may be taken from the figure.

Corresponding curves for the no-rain periods are given in figure 4. It is of interest to note the small values of persistency (in one case actually negative) which occur for the no-rain periods for small values of M. This fact may be interpreted to mean that a period of one or two no-rain days is not sufficient to establish a significant no-rain trend. It is not until a no-rain period has continued for about 6 days that the persistency begins to approach the highest value; the maximum persistency appears to occur on the ninth day.

It is of interest to compute the skill of "persistency forecasts." With the development of objective forecasting methods, the need for a measure of the success of a method has led to the development and use of a specialized type of skill score. This score is designed to measure the residual skill by the removal from consideration of those successful forecasts which would have been successful on a chance basis even though the forecaster had no meteoro-

logical information available. Thus, the forecaster is not given credit for the number of hits which would be attained with a purely random distribution of his forecasts throughout the month. On this basis for the determination of skill, a persistency forecast will attain a worthwhile score. The skill score S_c as generally used may be defined as follows: $S_c=\frac{C-E_c}{T-E_c}$, where C is the number of correct forecasts; E_c the number of forecasts expected to be correct due to chance; and T the total number of forecasts. Out of the 100 persistency forecasts, the percentage frequencies obtained from figures 1 and 2 give the number of correct forecasts, C, for those situations to which the charts apply. The number of correct forecasts out of 100 expected to be correct due to chance, E_c, is given by the percentage at the tops of the graphs. By our definition, persistency is the difference between these two percentages. Expressing persistency, P, as a decimal we may write the equality $PT=C-E_c$. Hence, $S_c=\frac{PT}{T-E_c}$. For $N=1$, the most common type of forecast, $E_c=T/3$ for the rain cases at San Francisco, and for the no-rain cases $E_c=2T/3$. Therefore, for the persistency rain forecasts, $S_c=3P/2$, where P is expressed as a decimal; and for the persistency no-rain forecasts, similarly, $S_c=3P$.

It is seen therefore that, for a given value of N, the skill score may be obtained by multiplying the value of persistency expressed as a decimal by a constant factor. Scales giving the skill scores of persistency forecasts corresponding to the persistencies indicated have been entered at the right-hand edges of figures 3 and 4. These figures indicate that for the number of days considered, the skill of persistency rain forecasts varies from about .10 up to .55, and for persistency no-rain forecasts from slightly negative values to about .70.

An average skill score for day-to-day persistency forecasts may be obtained through a consideration of the average number of rain periods per month. For a 30-day month this number is about 3.8. Assuming a missed forecast at the beginning and end of each period, the total misses per month would be 7.6. Calculating the skill score on this basis gives:

$$S_c=\frac{(30-7.6)-(\frac{1}{3}\times 10+\frac{2}{3}\times 20)}{30-(\frac{1}{3}\times 10+\frac{2}{3}\times 20)}=.43$$

CONCLUSIONS

1. Persistency is a very real meteorological phenomenon and deserves greater attention in the development of objective forecasting methods.
2. The importance of persistency probably rests on the fact that there are obscure factors involved in weather situations which are beyond the scope of expression by common meteorological variables. Persistency gives a rough integrated value of all variables. In this respect, persistency may be considered as a meteorological variable.
3. The study of persistency at a station provides the forecaster with an objective presentation which will aid him in evaluating the current weather trends.
4. A knowledge of persistency is essential to evaluate properly the skill of a forecasting method as evidenced by the skill score. For example, the difference between the attained skill score and the score due to persistency gives an indication of the ability of the method to forecast changes. If this difference is negative the method is not showing worthwhile skill.

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METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR NOVEMBER 1949

AEROLOGICAL OBSERVATIONS

[For description of change in Table 1 and charts, see REVIEW, January 1946, p. 6]

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meters, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during November 1949*

STATIONS AND MEAN SURFACE PRESSURES

Standard pressure surface (mb.)	Albany, N. Y. (1,001.3 mb.)				Albuquerque, N. Mex. (842.0 mb.)				Atlanta, Ga. (980.0 mb.)				Big Spring, Tex. (990.7 mb.)				Bismarck, N. Dak. (952.4 mb.)				Boise, Idaho (921.1 mb.)				Brownsville, Tex. (1,018.1 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	86	2.5	80	30	1,620	11.4	30	30	300	9.0	69	30	774	12.5	41	30	505	3.3	68	30	868	6.7	73	30	6	18.4	78
1,000	30	96	(*)	----	30	148	(*)	----	30	148	(*)	----	30	158	(*)	----	30	104	(*)	----	30	184	(*)	----	30	160	20.6	70
950	30	513	1.4	71	30	596	(*)	----	30	577	10.9	52	30	601	(*)	----	30	528	(*)	----	30	615	(*)	----	30	607	18.8	55
900	30	944	−.6	75	30	1,059	(*)	----	30	1,025	9.0	50	30	1,058	16.8	30	30	967	5.4	52	30	1,059	9.8	59	30	1,065	16.5	44
850	30	1,399	−2.7	74	30	1,540	(*)	----	30	1,497	7.4	47	30	1,543	14.0	29	30	1,433	3.5	44	30	1,535	9.4	48	30	1,549	14.1	35
800	30	1,878	−4.5	69	30	2,049	12.0	27	30	1,994	5.4	41	30	2,051	11.0	27	30	1,923	1.1	44	30	2,036	7.5	43	30	2,058	11.7	28
750	30	2,390	−6.8	64	30	2,591	8.8	27	30	2,524	3.1	35	30	2,592	7.9	27	30	2,446	−1.7	47	30	2,572	4.8	45	30	2,598	8.6	26
700	30	2,920	−8.9	59	30	3,153	5.4	27	30	3,075	.4	36	30	3,151	4.7	24	30	2,985	−4.9	45	30	3,124	1.4	44	30	3,162	5.7	24
650	29	3,491	−12.0	53	30	3,760	1.3	27	30	3,669	−2.5	31	30	3,755	1.0	22	30	3,572	−8.4	43	30	3,722	−2.3	43	30	3,768	2.3	----
600	29	4,097	−15.1	52	30	4,393	−2.6	27	30	4,298	−6.0	27	30	4,390	−2.3	----	30	4,181	−12.2	42	30	4,347	−6.3	41	30	4,406	−1.1	----
550	29	4,754	−18.6	49	30	5,078	−7.3	----	30	4,972	−10.5	----	30	5,073	−7.7	----	30	4,847	−15.9	43	29	5,025	−11.0	43	29	5,093	−5.3	----
500	29	5,455	−23.1	----	30	5,812	−12.6	----	30	5,699	−15.7	----	30	5,808	−12.6	----	30	5,553	−20.7	----	29	5,745	−15.9	43	29	5,836	−10.4	----
450	29	6,224	−28.3	----	29	6,615	−18.8	----	30	6,490	−21.3	----	30	6,609	−18.5	----	30	6,331	−26.2	----	29	6,538	−21.6	----	29	6,633	−15.9	----
400	29	7,054	−34.0	----	29	7,472	−25.4	----	30	7,344	−27.0	----	30	7,472	−25.5	----	30	7,164	−32.6	----	28	7,385	−28.0	----	29	7,517	−22.6	----
350	29	7,976	−39.8	----	27	8,430	−32.9	----	30	8,292	−34.0	----	30	8,425	−33.0	----	30	8,092	−39.3	----	28	8,329	−35.2	----	29	8,482	−29.6	----
300	29	9,014	−46.5	----	27	9,495	−41.1	----	30	9,355	−41.1	----	29	9,492	−40.9	----	29	9,120	−46.2	----	27	9,384	−42.6	----	29	9,563	−37.5	----
250	28	10,217	−50.7	----	26	10,708	−49.7	----	30	10,574	−48.0	----	27	10,710	−48.6	----	28	10,317	−52.0	----	26	10,612	−49.9	----	28	10,796	−46.1	----
200	26	11,660	−53.3	----	24	12,132	−57.5	----	30	12,019	−55.2	----	21	12,157	−56.1	----	26	11,753	−54.7	----	25	12,046	−55.9	----	27	12,251	−55.5	----
175	26	12,517	−54.3	----	21	12,963	−60.4	----	30	12,865	−58.1	----	21	12,997	−60.0	----	26	12,605	−55.5	----	24	12,889	−58.7	----	26	13,094	−59.7	----
150	18	13,470	−55.1	----	15	13,921	−62.9	----	28	13,829	−61.6	----	21	13,951	−64.1	----	22	13,582	−56.8	----	19	13,840	−61.7	----	25	14,042	−64.1	----
125	16	14,614	−56.3	----	10	15,029	−67.5	----	25	14,949	−65.0	----	17	15,061	−67.3	----	19	14,721	−58.5	----	9	14,967	−64.6	----	22	15,152	−68.3	----
100	11	16,038	−59.1	----	5	16,330	−70.0	----	22	16,303	−67.5	----	9	16,412	−71.1	----	12	16,123	−60.5	----	----	----	----	----	15	16,490	−72.9	----
80	6	17,422	−59.1	----	----	----	----	----	14	17,646	−67.2	----	----	----	----	----	6	17,497	−60.4	----	----	----	----	----	5	17,764	−72.3	----

Standard pressure surface (mb.)	Buffalo, N. Y. (984.4 mb.)				Camaguey, Cuba [1] (—— mb.)				Caribou, Maine (987.3 mb.)				Charleston, S. C. (1,014.5 mb.)				Ciudad Victoria, Mex. (978.9 mb.)				Columbia, Mo. (987.1 mb.)				Dodge City, Kans. (926.1 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	221	2.9	79	----	----	----	----	30	191	−3.7	85	30	18	10.5	81	30	335	22.2	45	30	239	7.7	58	30	792	8.5	53
1,000	30	93	(*)	----	----	----	----	----	30	89	(*)	----	30	138	13.3	65	30	147	(*)	----	30	129	(*)	----	30	146	(*)	----
950	30	511	1.7	76	----	----	----	----	30	499	−2.8	78	30	578	12.2	53	30	594	21.8	41	30	558	8.7	48	30	581	(*)	----
900	30	943	−.4	75	----	----	----	----	30	923	−4.5	76	30	1,021	9.9	47	30	1,061	18.2	44	30	1,000	6.4	47	30	1,032	13.6	37
850	30	1,398	−2.6	73	----	----	----	----	30	1,372	−5.7	72	30	1,495	8.2	43	30	1,547	14.3	46	30	1,466	4.4	45	30	1,511	11.8	33
800	30	1,877	−4.9	70	----	----	----	----	30	1,846	−7.1	63	30	1,993	5.9	42	30	2,055	10.8	46	30	1,958	2.2	44	30	2,015	8.8	33
750	30	2,390	−7.1	65	----	----	----	----	30	2,353	−8.9	60	30	2,527	3.8	37	30	2,594	7.5	47	30	2,482	−.2	40	30	2,551	5.8	33
700	30	2,918	−9.8	63	----	----	----	----	30	2,880	−10.9	59	30	3,077	1.4	33	30	3,155	4.9	41	30	3,027	−2.5	35	30	3,107	2.6	31
650	29	3,494	−12.6	57	----	----	----	----	30	3,452	−13.5	56	30	3,674	−1.6	31	29	3,760	1.7	33	30	3,617	−5.7	32	30	3,706	−.8	30
600	29	4,094	−15.6	54	----	----	----	----	30	4,053	−16.6	54	30	4,304	−5.2	----	29	4,397	−1.2	----	30	4,234	−9.2	32	30	4,337	−5.2	31
550	28	4,752	−19.0	51	----	----	----	----	30	4,701	−20.2	----	29	4,982	−9.6	----	29	5,087	−5.1	----	30	4,907	−12.9	31	30	5,014	−10.0	33
500	28	5,452	−23.5	----	----	----	----	----	30	5,402	−24.7	----	29	5,710	−14.7	----	28	5,828	−10.0	----	30	5,623	−17.5	30	30	5,742	−15.1	----
450	28	6,216	−28.9	----	----	----	----	----	30	6,166	−29.4	----	29	6,507	−20.4	----	28	6,636	−16.2	----	30	6,411	−23.0	----	30	6,531	−20.8	----
400	28	7,047	−35.1	----	----	----	----	----	30	6,994	−34.7	----	29	7,365	−26.6	----	28	7,507	−22.8	----	30	7,257	−29.2	----	29	7,389	−27.3	----
350	28	7,966	−41.2	----	----	----	----	----	30	7,917	−39.9	----	27	8,328	−33.0	----	28	8,472	−30.1	----	30	8,198	−35.6	----	29	8,336	−34.7	----
300	26	9,003	−46.6	----	----	----	----	----	29	8,961	−45.3	----	26	9,396	−40.0	----	28	9,551	−38.1	----	29	9,252	−43.1	----	28	9,392	−42.4	----
250	23	10,215	−51.3	----	----	----	----	----	29	10,163	−50.0	----	26	10,622	−47.2	----	28	10,782	−46.9	----	29	10,458	−50.4	----	28	10,601	−50.6	----
200	23	11,656	−53.2	----	----	----	----	----	29	11,612	−51.8	----	25	12,077	−55.1	----	27	12,223	−57.2	----	28	11,898	−55.0	----	28	12,030	−57.8	----
175	22	12,513	−53.9	----	----	----	----	----	26	12,468	−51.9	----	22	12,921	−59.4	----	27	13,057	−62.1	----	27	12,755	−56.5	----	27	12,860	−61.1	----
150	20	13,514	−55.3	----	----	----	----	----	23	13,467	−52.9	----	17	13,904	−62.6	----	25	13,992	−66.5	----	25	13,740	−59.2	----	18	13,806	−61.3	----
125	18	14,661	−57.3	----	----	----	----	----	16	14,675	−55.6	----	17	15,018	−66.2	----	25	15,083	−70.7	----	14	14,898	−63.2	----	16	14,940	−64.0	----
100	11	16,017	−59.0	----	----	----	----	----	10	16,112	−56.6	----	11	16,362	−69.4	----	19	16,394	−75.0	----	7	16,266	−65.8	----	9	16,310	−65.9	----
80	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	16	17,688	−73.4	----	----	----	----	----	5	17,674	−66.3	----
60	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	5	19,404	−66.2	----	----	----	----	----	----	----	----	----

See footnotes at end of table.

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meters, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during November 1949*—Continued

Standard pressure surface (mb.)	El Paso, Tex. (886.0 mb.)				Ely, Nev. (814.6 mb.)				Glasgow, Mont. (938.1 mb.)				Grand Junction, Colo. (858.4 mb.)				Great Falls, Mont. (887.5 mb.)				Greensboro, N. C. (982.9 mb.)				Hatteras, N. C. (1,014.1 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	1,195	13.0	37	30	1,908	1.6	62	30	648	4.4	56	30	1,474	6.2	52	30	1,128	8.5	44	30	273	7.0	74	30	3	13.4	73
1,000	30	156	(*)	....	30	200	(*)	....	30	118	(*)	....	30	193	(*)	....	30	125	(*)	....	30	129	(*)	....	30	121	13.6	65
950	30	605	(*)	....	30	635	(*)	....	30	546	(*)	....	30	633	(*)	....	30	566	(*)	....	30	555	10.0	52	30	557	11.7	54
900	30	1,069	(*)	....	30	1,086	(*)	....	30	989	8.8	40	30	1,083	(*)	....	30	1,015	(*)	....	30	1,003	7.5	51	30	1,003	9.4	48
850	30	1,547	15.4	28	30	1,557	(*)	....	30	1,460	6.4	38	30	1,555	10.1	43	30	1,487	9.2	38	30	1,472	5.1	53	30	1,475	7.3	44
800	30	2,057	12.3	27	30	2,057	9.0	45	30	1,954	3.3	40	30	2,058	9.0	38	30	1,985	5.7	39	30	1,965	3.1	49	30	1,972	4.9	43
750	30	2,600	8.9	26	30	2,595	7.5	37	30	2,479	−.1	42	30	2,595	6.8	36	30	2,514	2.1	39	30	2,490	.4	47	30	2,498	2.4	42
700	30	3,162	5.6	23	30	3,155	3.9	36	30	3,023	−3.6	44	30	3,154	3.4	35	30	3,063	−1.7	40	30	3,036	−2.3	43	30	3,050	−.2	39
650	30	3,768	1.6	....	30	3,754	.0	36	30	3,610	−7.1	46	30	3,754	−.1	31	30	3,655	−5.4	37	29	3,622	−5.3	40	30	3,643	−3.0	34
600	29	4,405	−2.7	....	30	4,388	−4.0	35	30	4,225	−11.1	43	30	4,387	−4.2	32	30	4,272	−9.3	35	29	4,243	−8.7	39	30	4,270	−6.5	32
550	28	5,089	−7.4	....	30	5,069	−8.6	34	30	4,890	−15.4	37	30	5,068	−8.6	31	30	4,943	−13.9	36	28	4,913	−13.1	36	30	4,945	−10.7	31
500	27	5,823	−12.6	....	30	5,801	−13.4	....	28	5,611	−19.9	....	30	5,799	−13.6	33	30	5,656	−18.5	38	28	5,630	−17.9	35	30	5,671	−15.6	33
450	26	6,625	−18.3	....	30	6,602	−19.2	....	28	6,386	−25.3	....	30	6,594	−19.6	35	30	6,443	−24.3	....	28	6,415	−23.0	....	30	6,464	−20.9	....
400	22	7,486	−24.9	....	30	7,460	−25.5	....	28	7,229	−31.3	....	30	7,454	−26.2	....	30	7,281	−30.6	....	28	7,263	−28.5	....	30	7,320	−26.8	....
350	22	8,442	−32.4	....	30	8,414	−33.1	....	27	8,162	−38.1	....	30	8,406	−33.3	....	30	8,215	−37.5	....	28	8,206	−35.2	....	30	8,270	−33.2	....
300	20	9,510	−41.2	....	28	9,489	−41.4	....	27	9,205	−45.7	....	30	9,469	−41.6	....	30	9,266	−44.5	....	28	9,264	−42.3	....	30	9,337	−40.0	....
250	19	10,724	−49.9	....	27	10,703	−50.0	....	26	10,397	−52.6	....	30	10,681	−50.0	....	27	10,487	−51.4	....	28	10,478	−48.6	....	29	10,569	−46.8	....
200	14	12,164	−57.4	....	25	12,138	−57.5	....	23	11,814	−55.4	....	28	12,123	−57.5	....	19	11,946	−57.1	....	28	11,929	−53.8	....	26	12,016	−54.1	....
175	12	12,994	−61.3	....	24	12,970	−60.6	....	15	12,667	−56.3	....	28	12,959	−60.8	....	18	12,787	−58.2	....	27	12,781	−56.1	....	21	12,860	−57.0	....
150	11	13,946	−66.3	....	19	13,922	−64.4	....	11	13,694	−58.5	....	23	13,907	−63.6	....	13	13,735	−58.5	....	25	13,749	−58.5	....	15	13,852	−60.0	....
125	7	15,036	−69.5	....	16	15,052	−67.0	....	5	14,856	−59.7	....	20	15,027	−66.2	....	10	14,864	−61.3	....	20	14,895	−61.6	....	9	14,986	−62.5	....
100	5	16,379	−72.3	....	5	16,398	−69.5	....	....	....	....	....	13	16,376	−68.8	....	5	16,240	−63.1	....	16	16,262	−63.1	....	5	16,338	−63.6	....
80	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	17,662	−63.9	....	....	....	....	....

Standard pressure surface (mb.)	Havana, Cuba [1] (—— mb.)				Honolulu, T. H. 1,015.7 mb.)				International Falls, Minn. (966.8 mb.)				Joliet, Ill. (991.2 mb.)				Lake Charles, La. (1,018.6 mb.)				Lander, Wyo. (831.5 mb.)				Las Vegas, Nev. (942.0 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	....	....	....	....	30	3	24.6	63	30	360	−1.6	82	30	178	3.6	75	30	5	13.4	81	30	1,696	4.8	53	30	660	13.2	32
1,000	....	....	....	....	30	139	22.8	66	30	89	(*)	....	30	104	(*)	....	30	161	16.5	64	30	154	(*)	....	30	149	(*)	....
950	....	....	....	....	30	586	19.3	71	30	501	−1.5	79	30	525	4.4	65	30	600	14.5	54	30	592	(*)	....	30	590	(*)	....
900	....	....	....	....	30	1,047	15.7	76	30	928	−3.1	77	30	962	2.1	63	30	1,052	12.4	46	30	1,044	(*)	....	30	1,052	19.4	23
850	....	....	....	....	30	1,531	12.6	77	30	1,381	−3.5	67	30	1,422	.3	57	30	1,531	11.3	33	30	1,514	(*)	....	30	1,540	16.5	22
800	....	....	....	....	30	2,039	11.4	57	30	1,859	−4.7	57	30	1,906	−1.8	56	30	2,036	9.3	26	30	2,015	9.0	35	30	2,052	13.2	23
750	....	....	....	....	30	2,585	10.9	33	30	2,371	−6.7	57	30	2,422	−4.1	55	30	2,575	6.7	25	30	2,552	5.9	34	30	2,594	9.5	24
700	....	....	....	....	30	3,151	8.2	29	30	2,902	−9.1	57	30	2,959	−6.6	55	30	3,131	3.6	26	30	3,108	2.5	34	30	3,159	5.8	23
650	....	....	....	....	29	3,761	4.6	29	30	3,478	−11.7	50	30	3,544	−9.1	51	29	3,729	.5	....	30	3,708	−1.5	35	30	3,765	2.0	23
600	....	....	....	....	29	4,405	.7	....	30	4,081	−15.2	49	30	4,151	−12.6	46	29	4,365	−3.4	....	30	4,335	−5.6	34	30	4,402	−2.3	....
550	....	....	....	....	29	5,096	−3.5	....	30	4,737	−18.8	50	30	4,812	−16.9	41	29	5,048	−7.9	....	30	5,015	−10.2	32	30	5,086	−6.7	....
500	....	....	....	....	28	5,846	−8.4	....	30	5,438	−23.1	....	30	5,518	−21.7	....	29	5,781	−13.2	....	30	5,739	−15.3	33	30	5,824	−12.1	....
450	....	....	....	....	28	6,662	−14.1	....	30	6,205	−28.5	....	30	6,293	−27.0	....	29	6,582	−19.0	....	30	6,534	−21.1	....	30	6,629	−18.2	....
400	....	....	....	....	28	7,540	−20.8	....	29	7,043	−34.0	....	30	7,126	−32.6	....	29	7,440	−25.5	....	30	7,384	−27.8	....	30	7,491	−25.1	....
350	....	....	....	....	28	8,512	−28.4	....	29	7,965	−40.5	....	30	8,053	−39.1	....	28	8,397	−32.4	....	30	8,329	−34.9	....	30	8,446	−32.7	....
300	....	....	....	....	27	9,601	−36.4	....	29	8,999	−47.0	....	30	9,096	−44.8	....	28	9,465	−39.9	....	30	9,386	−42.8	....	29	9,524	−41.0	....
250	....	....	....	....	26	10,843	−45.3	....	27	10,187	−52.2	....	30	10,300	−50.4	....	28	10,689	−47.5	....	30	10,592	−51.2	....	28	10,739	−49.7	....
200	....	....	....	....	24	12,298	−55.1	....	20	11,644	−52.3	....	28	11,751	−53.4	....	27	12,137	−55.5	....	28	12,010	−58.0	....	27	12,173	−57.8	....
175	....	....	....	....	24	13,140	−60.5	....	18	12,513	−52.8	....	27	12,610	−54.8	....	25	12,978	−59.4	....	27	12,850	−60.7	....	25	13,001	−61.4	....
150	....	....	....	....	20	14,080	−65.4	....	13	13,483	−52.3	....	25	13,584	−56.4	....	25	13,933	−63.3	....	25	13,814	−62.6	....	23	13,955	−64.5	....
125	....	....	....	....	17	15,173	−70.5	....	....	....	....	....	21	14,729	−58.7	....	25	15,042	−67.1	....	24	14,937	−64.3	....	17	15,056	−67.9	....
100	....	....	....	....	13	16,490	−72.9	....	....	....	....	....	13	16,141	−59.8	....	23	16,376	−71.0	....	20	16,288	−65.8	....	16	16,398	−69.9	....
80	....	....	....	....	7	17,806	−72.7	....	....	....	....	....	....	....	....	....	15	17,689	−71.3	....	10	17,608	−66.1	....	12	17,725	−70.3	....
60	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8	19,402	−66.6	....	....	....	....	....	7	19,441	−66.9	....

Standard pressure surface (mb.)	Little Rock, Ark. (1,008.2 mb.)				Mazatlan, Mex. (1,010.9 mb.)				Medford, Oreg. (972.2 mb.)				Merida, Mex. (1,014.8 mb.)				Miami, Fla. (1,016.9 mb.)				Nantucket, Mass. (1,009.6 mb.)				Nashville, Tenn. (995.6 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	29	79	10.9	62	30	14	25.2	76	30	401	7.5	84	30	27	22.2	73	30	4	19.0	78	30	14	7.7	82	30	177	8.1	67
1,000	29	147	12.6	55	30	109	24.5	76	30	167	(*)	....	30	155	22.0	72	30	148	20.4	69	30	93	8.1	75	30	140	(*)	....
950	29	578	13.2	48	30	570	24.8	44	30	598	11.6	69	30	599	19.0	73	30	593	17.9	67	30	518	5.9	72	30	569	8.7	52
900	29	1,031	10.7	47	30	1,032	22.5	37	30	1,047	12.8	48	30	1,062	15.7	73	30	1,051	15.0	65	30	957	3.7	70	30	1,010	6.5	51
850	29	1,506	9.0	41	30	1,527	19.4	35	30	1,525	10.7	45	30	1,546	13.0	66	30	1,533	13.0	54	30	1,420	1.9	63	30	1,478	4.6	48
800	29	2,005	7.0	37	30	2,044	15.9	31	30	2,027	7.3	47	30	2,054	10.8	53	30	2,042	11.4	43	30	1,907	.1	59	30	1,970	2.4	46
750	29	2,538	4.5	38	30	2,594	11.9	33	30	2,556	4.4	42	30	2,595	9.0	39	30	2,584	9.3	....	30	2,428	−1.9	53	30	2,495	−.2	45
700	29	3,092	1.5	38	30	3,162	8.0	34	30	3,113	1.3	44	30	3,160	7.5	....	30	3,148	6.8	....	30	2,968	−4.8	49	30	3,038	−2.7	40
650	28	3,689	−1.7	34	30	3,777	4.3	27	30	3,706	−2.7	38	30	3,770	4.7	....	30	3,756	3.8	....	30	3,556	−7.8	47	30	3,627	−5.5	37
600	28	4,317	−5.2	28	30	4,417	.4	....	30	4,335	−6.7	36	30	4,417	1.4	....	30	4,399	.0	....	29	4,173	−11.1	43	30	4,246	−8.8	31
550	27	4,995	−9.4	28	29	5,112	−3.9	....	30	5,010	−11.2	37	30	5,110	−2.8	....	29	5,092	−4.1	....	29	4,831	−14.8	37	29	4,919	−12.6	31
500	27	5,724	−14.4	....	29	5,855	−9.4	....	30	5,734	−16.1	40	30	5,861	−7.2	....	29	5,836	−8.9	....	28	5,538	−19.7	....	29	5,640	−17.3	30
450	27	6,518	−20.2	....	29	6,674	−15.3	....	30	6,523	−21.7	....	30	6,678	−13.0	....	29	6,652	−14.4	....	27	6,327	−24.6	....	29	6,427	−22.8	....
400	27	7,375	−27.3	....	28	7,541	−21.9	....	29	7,375	−27.8	....	30	7,560	−19.3	....	28	7,530	−20.5	....	27	7,164	−29.9	....	29	7,274	−28.9	....
350	26	8,328	−34.1	....	27	8,512	−28.9	....	29	8,321	−34.9	....	30	8,538	−26.8	....	27	8,504	−27.1	....	26	8,097	−36.5	....	29	8,215	−36.0	....
300	26	9,390	−41.5	....	26	9,593	−37.3	....	29	9,380	−42.4	....	30	9,631	−35.0	....	27	9,596	−34.8	....	25	9,145	−43.9	....	29	9,270	−42.5	....
250	26	10,608	−48.1	....	24	10,826	−47.0	....	28	10,585	−50.4	....	30	10,877	−44.9	....	27	10,844	−44.3	....	24	10,343	−49.4	....	29	10,481	−49.2	....
200	24	12,054	−54.4	....	24	12,271	−57.0	....	25	12,012	−56.1	....	30	12,329	−56.7	....	22	12,303	−55.7	....	23	11,793	−53.2	....	28	11,934	−54.5	....
175	24	12,903	−57.2	....	22	13,109	−61.6	....	22	12,868	−59.0	....	30	13,163	−63.0	....	18	13,130	−61.1	....	21	12,661	−55.0	....	27	12,783	−56.8	....
150	21	13,855	−60.5	....	21	14,055	−65.8	....	20	13,828	−61.6	....	29	14,096	−69.3	....	9	14,066	−65.8	....	20	13,649	−56.6	....	22	13,749	−60.1	....
125	19	14,989	−63.3	....	19	15,149	−69.8	....	8	14,945	−64.4	....	27	15,167	−74.8	....	....	....	....	....	20	14,810	−59.0	....	20	14,886	−62.8	....
100	14	16,342	−66.2	....	18	16,468	−73.2	....	....	....	....	....	23	16,448	−79.2	....	....	....	....	....	10	16,224	−60.4	....	12	16,244	−65.4	....
80	....	....	....	....	15	17,774	−73.7	....	....	....	....	....	16	17,719	−77.8	....	....	....	....	....	....	....	....	....	5	17,613	−64.7	....
60	....	....	....	....	9	19,473	−68.1	....	....	....	....	....	8	19,418	−68.2	....	....	....	....	....	....	....	....	....	....	....	....	....
50	....	....	....	....	5	20,582	−64.3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

See footnotes at end of table.

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meters, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during November 1949*—Continued

Standard pressure surface (mb.)	New Orleans, La. (1,019.5 mb.)				North Platte, Nebr. (918.3 mb.)				Oakland, Calif. (1,018.4 mb.)				Oklahoma City, Okla. (972.3 mb.)				Omaha, Nebr. (978.4 mb.)				Phoenix, Ariz. (977.0 mb.)				Pittsburgh, Pa. (967.4 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	2	12.8	82	30	849	5.0	64	29	6	14.4	78	29	391	10.3	57	29	308	7.8	56	29	339	16.1	50	30	382	4.6	72
1,000	30	165	15.9	68	30	138	(*)	----	29	161	16.7	67	29	154	(*)	----	29	125	(*)	----	29	139	(*)	----	30	110	(*)	----
950	30	603	14.2	57	30	568	(*)	----	29	604	17.1	52	29	590	14.3	43	29	552	8.7	48	29	586	24.2	25	30	534	4.8	68
900	30	1,055	12.2	49	30	1,015	9.9	45	29	1,058	15.7	43	29	1,041	13.3	36	29	997	7.5	48	29	1,053	21.5	22	30	969	2.6	67
850	30	1,533	10.8	36	30	1,489	8.9	36	29	1,541	13.4	39	29	1,520	11.1	36	29	1,466	5.7	42	29	1,544	18.1	22	30	1,429	.1	66
800	30	2,036	8.9	30	30	1,989	6.2	36	29	2,048	10.5	35	29	2,023	8.4	33	29	1,959	3.2	40	29	2,059	14.5	24	30	1,913	−2.1	60
750	30	2,571	6.6	25	30	2,517	3.0	38	29	2,586	7.3	35	29	2,558	5.8	32	29	2,488	.5	38	29	2,605	10.8	24	30	2,431	−4.3	53
700	30	3,131	4.0	24	30	3,070	−.2	38	29	3,146	3.9	36	29	3,115	2.8	29	29	3,031	−2.4	36	29	3,170	7.4	21	30	2,964	−6.9	54
650	30	3,727	.5	----	30	3,662	−3.9	41	29	3,746	.1	37	29	3,714	−.6	26	29	3,621	−5.6	35	28	3,786	3.8	----	30	3,548	−10.0	50
600	29	4,367	−3.0	----	30	4,286	−7.8	40	29	4,380	−4.1	37	29	4,345	−4.5	----	29	4,239	−9.1	36	28	4,426	−.8	----	30	4,152	−13.6	48
550	29	5,047	−7.4	----	30	4,961	−12.1	40	29	5,061	−8.7	35	29	5,023	−8.8	----	28	4,910	−12.9	37	28	5,113	−5.7	----	30	4,813	−17.5	43
500	29	5,786	−12.4	----	28	5,682	−16.6	----	29	5,792	−13.8	33	29	5,756	−13.8	----	28	5,628	−17.6	39	28	5,853	−10.9	----	30	5,516	−21.6	----
450	27	6,585	−18.0	----	28	6,471	−22.4	----	29	6,595	−19.4	36	29	6,550	−20.0	----	28	6,419	−22.8	----	27	6,663	−16.8	----	30	6,292	−26.5	----
400	27	7,454	−24.1	----	28	7,319	−28.7	----	29	7,450	−25.9	----	29	7,410	−26.8	----	28	7,265	−28.9	----	27	7,529	−23.7	----	30	7,127	−32.5	----
350	26	8,416	−31.2	----	26	8,266	−35.5	----	29	8,402	−33.4	----	29	8,358	−34.0	----	28	8,206	−35.8	----	27	8,488	−31.8	----	29	8,050	−38.6	----
300	24	9,494	−38.6	----	25	9,322	−43.5	----	29	9,465	−41.8	----	28	9,421	−41.9	----	28	9,261	−43.1	----	27	9,557	−40.5	----	28	9,099	−44.7	----
250	24	10,726	−46.2	----	24	10,531	−51.5	----	29	10,677	−50.0	----	28	10,634	−49.8	----	27	10,475	−50.6	----	26	10,770	−49.2	----	25	10,304	−49.8	----
200	24	12,179	−54.6	----	24	11,955	−58.2	----	26	12,130	−57.5	----	25	12,067	−57.6	----	26	11,909	−56.0	----	25	12,205	−57.0	----	21	11,766	−52.5	----
175	24	13,025	−58.8	----	23	12,788	−60.6	----	24	12,969	−60.5	----	24	12,907	−60.4	----	26	12,755	−57.1	----	23	13,047	−60.3	----	19	12,624	−54.3	----
150	22	13,987	−63.0	----	21	13,751	−61.9	----	22	13,925	−62.9	----	22	13,853	−63.0	----	24	13,726	−59.2	----	19	13,999	−64.2	----	14	13,619	−56.7	----
125	21	15,099	−66.7	----	18	14,875	−63.7	----	18	15,044	−66.1	----	14	14,956	−65.6	----	23	14,866	−61.7	----	16	15,087	−67.1	----				
100	17	16,423	−69.6	----	15	16,251	−66.0	----	11	16,394	−69.6	----					21	16,251	−63.7	----	11	16,452	−69.5	----				
80	16	17,762	−68.4	----	6	17,611	−64.7	----	6	17,711	−69.5	----					14	17,633	−63.6	----								
60																	5	19,385	−63.4	----								

Standard pressure surface (mb.)	Portland, Maine (1,008.6 mb.)				Rapid City, S. Dak. (902.8 mb.)				St. Cloud, Minn. (973.5 mb.)				San Antonio, Tex. (991.1 mb.)				San Juan, P. R.[1] (1,011.8 mb.)				Santa Maria, Calif. (1,009.8 mb.)				Sault Ste. Marie, Mich. (983.0 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	20	2.0	84	30	980	5.4	54	30	317	.7	79	30	240	14.1	67	22	19	24.3	89	30	71	13.4	77	30	221	−0.8	80
1,000	30	89	2.8	76	30	127	(*)	----	30	100	(*)	----	30	163	(*)	----	29	120	24.4	84	30	153	15.6	66	30	82	(*)	----
950	30	508	1.9	76	30	562	(*)	----	30	520	1.9	73	30	606	19.0	45	29	575	22.0	81	30	596	19.3	40	30	497	−2.1	78
900	30	939	−.5	67	30	1,007	(*)	----	30	949	1.2	65	30	1,065	16.0	46	29	1,038	19.2	80	30	1,056	18.3	31	30	921	−3.9	78
850	30	1,394	−2.6	69	30	1,479	8.7	38	30	1,409	.5	56	30	1,548	13.2	45	29	1,530	16.3	76	30	1,543	15.6	28	30	1,370	−5.7	73
800	30	1,874	−4.5	65	30	1,977	5.3	38	30	1,894	−1.2	54	30	2,055	10.9	34	29	2,043	13.8	70	30	2,053	12.3	28	30	1,844	−7.8	70
750	30	2,388	−6.0	57	30	2,507	2.1	39	30	2,413	−3.8	51	30	2,595	8.0	28	29	2,593	11.3	64	30	2,593	8.9	27	30	2,350	−9.7	64
700	30	2,919	−8.2	56	30	3,054	−1.4	41	30	2,949	−6.5	50	30	3,156	5.2	24	29	3,160	8.6	52	30	3,157	5.3	25	30	2,874	−11.9	61
650	30	3,498	−11.2	53	30	3,646	−5.1	40	30	3,531	−9.3	50	30	3,758	1.7	22	29	3,779	5.5	46	30	3,761	1.5	----	30	3,444	−14.2	55
600	30	4,102	−14.8	52	30	4,264	−8.7	39	30	4,140	−12.5	47	29	4,397	−2.1	----	29	4,421	2.1	38	30	4,398	−2.7	----	30	4,042	−17.1	49
550	30	4,757	−18.3	44	30	4,938	−12.6	37	29	4,800	−17.0	47	29	5,079	−6.7	----	29	5,119	−1.7	----	30	5,078	−7.0	----	30	4,696	−20.6	----
500	29	5,456	−22.8	----	30	5,653	−17.4	35	29	5,505	−21.7	----	29	5,819	−11.9	----	29	5,870	−6.2	----	30	5,818	−12.2	----	28	5,387	−25.1	----
450	28	6,230	−27.8	----	30	6,441	−23.0	----	29	6,274	−27.3	----	29	6,623	−18.0	----	29	6,693	−11.3	----	30	6,622	−18.0	----	28	6,154	−30.3	----
400	26	7,074	−32.8	----	29	7,285	−29.3	----	29	7,111	−33.2	----	29	7,486	−24.6	----	28	7,581	−17.8	----	30	7,486	−24.7	----	28	6,973	−36.2	----
350	24	8,012	−38.8	----	28	8,228	−36.1	----	28	8,026	−39.6	----	29	8,443	−31.7	----	28	8,565	−24.9	----	29	8,442	−32.3	----	28	7,898	−42.5	----
300	22	9,069	−45.2	----	27	9,289	−43.3	----	28	9,067	−45.3	----	27	9,512	−39.6	----	28	9,667	−33.4	----	29	9,510	−40.7	----	28	8,915	−47.9	----
250	18	10,281	−50.3	----	27	10,496	−50.8	----	27	10,265	−50.4	----	26	10,736	−47.4	----	27	10,919	−43.8	----	29	10,727	−49.6	----	26	10,097	−51.3	----
200	16	11,727	−53.7	----	27	11,926	−56.6	----	26	11,711	−53.3	----	25	12,186	−54.8	----	27	12,380	−55.2	----	27	12,162	−57.4	----	23	11,548	−51.1	----
175	16	12,585	−54.3	----	24	12,772	−57.8	----	25	12,560	−53.2	----	23	13,030	−57.9	----	26	13,220	−61.5	----	25	13,001	−60.8	----	19	12,413	−51.5	----
150	12	13,554	−55.2	----	21	13,758	−59.3	----	21	13,539	−54.4	----	17	13,991	−62.5	----	25	14,158	−68.2	----	25	13,952	−63.6	----	15	13,410	−52.7	----
125	10	14,718	−58.3	----	17	14,906	−61.9	----	20	14,703	−56.0	----	14	15,108	−65.8	----	22	15,233	−74.3	----	19	15,057	−65.8	----	9	14,611	−55.7	----
100	6	16,145	−57.9	----	7	16,273	−65.4	----	15	16,127	−58.3	----	9	16,453	−69.7	----	18	16,516	−78.9	----	16	16,405	−67.1	----				
80													6	17,794	−69.7	----	6	17,700	−78.0	----	7	17,790	−67.7	----				

Standard pressure surface (mb.)	Spokane, Wash. (934.7 mb.)				Swan Island, W. I. (1,013.1 mb.)				Tacubaya, Mexico (775.3 mb.)				Tampa, Fla. (1,017.6 mb.)				Tatoosh Island, Wash. (1,010.5 mb.)				Toledo, Ohio (988.7 mb.)				Washington, D. C. (1,010.8 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	721	5.2	83	30	10	25.3	78	28	2,306	12.5	43	30	9	15.6	81	30	31	10.6	84	30	191	3.4	81	30	25	8.4	64
1,000	30	164	(*)	----	30	124	24.4	79	28	105	(*)	----	30	158	17.6	68	30	118	(*)	----	30	97	(*)	----	30	113	8.6	61
950	30	590	(*)	----	30	573	21.2	82	28	560	(*)	----	30	595	15.1	64	30	553	10.4	60	30	519	3.6	72	30	537	6.9	59
900	30	1,032	7.3	69	30	1,040	18.0	83	28	1,032	(*)	----	30	1,051	12.9	54	30	994	8.2	67	30	953	.1	69	30	979	4.3	60
850	30	1,502	6.3	59	30	1,529	15.3	80	28	1,521	(*)	----	30	1,531	11.3	43	30	1,464	5.6	66	30	1,411	−1.1	63	30	1,442	1.8	61
800	30	1,997	4.2	54	30	2,042	13.4	67	28	2,042	(*)	----	30	2,036	9.8	33	30	1,958	2.9	65	30	1,893	−2.8	58	30	1,928	−.6	60
750	30	2,525	1.5	51	30	2,589	11.1	60	28	2,588	11.5	42	30	2,576	7.5	31	30	2,487	.1	65	30	2,411	−5.2	54	30	2,446	−2.8	57
700	30	3,072	−1.8	54	30	3,158	8.5	57	28	3,157	8.0	45	30	3,135	4.9	----	30	3,027	−3.0	64	30	2,942	−7.8	54	30	2,987	−5.1	53
650	30	3,662	−5.0	50	30	3,772	5.0	58	28	3,771	4.0	48	30	3,740	1.8	----	30	3,616	−6.8	62	30	3,525	−10.7	54	30	3,570	−7.9	48
600	30	4,284	−8.8	51	30	4,416	1.3	56	28	4,412	.7	38	30	4,377	−1.9	----	30	4,231	−10.5	61	29	4,129	−14.3	50	29	4,185	−11.3	45
550	30	4,954	−13.0	52	29	5,114	−2.4	49	28	5,110	−2.5	----	30	5,065	−6.0	----	30	4,896	−14.8	60	29	4,788	−18.6	47	29	4,851	−15.6	43
500	30	5,672	−17.8	48	29	5,864	−6.6	46	28	5,858	−7.2	----	30	5,803	−10.9	----	30	5,609	−19.4	56	29	5,488	−23.4	----	29	5,561	−20.0	37
450	30	6,456	−23.4	----	29	6,689	−11.7	40	28	6,683	−12.9	----	30	6,612	−16.7	----	30	6,390	−24.5	----	29	6,256	−28.8	----	29	6,341	−25.1	----
400	30	7,302	−29.7	----	29	7,573	−17.5	----	28	7,559	−19.5	----	30	7,479	−22.8	----	30	7,232	−30.4	----	28	7,091	−34.1	----	29	7,180	−31.0	----
350	30	8,239	−36.9	----	29	8,559	−24.6	----	27	8,536	−27.2	----	30	8,445	−29.5	----	30	8,168	−36.7	----	28	8,013	−39.9	----	29	8,115	−37.0	----
300	26	9,272	−44.6	----	28	9,663	−33.2	----	27	9,627	−35.9	----	28	9,524	−36.9	----	28	9,225	−43.2	----	26	9,061	−44.9	----	29	9,165	−44.0	----
250	24	10,498	−50.2	----	27	10,916	−43.6	----	27	10,869	−45.4	----	26	10,768	−45.8	----	25	10,441	−49.0	----	26	10,267	−48.9	----	29	10,371	−49.5	----
200	16	11,969	−55.8	----	27	12,376	−55.6	----	27	12,321	−56.8	----	24	12,218	−56.4	----	20	11,917	−54.7	----	25	11,719	−52.6	----	29	11,818	−53.3	----
175	15	12,819	−58.5	----	25	13,212	−61.9	----	25	13,156	−62.9	----	23	13,051	−61.7	----	19	12,762	−56.2	----	22	12,572	−53.3	----	29	12,674	−55.3	----
150	10	13,778	−59.4	----	22	14,152	−68.4	----	23	14,097	−68.0	----	22	13,998	−65.7	----	16	13,762	−56.7	----	20	13,578	−56.1	----	27	13,650	−56.7	----
125	5	14,968	−61.4	----	8	15,219	−74.3	----	23	15,180	−72.2	----	18	15,098	−69.8	----	9	14,964	−60.0	----	15	14,763	−59.4	----	27	14,789	−59.7	----
100									20	16,483	−76.4	----	15	16,419	−73.0	----					13	16,146	−61.9	----	25	16,188	−61.8	----
80									14	17,750	−77.0	----	11	17,725	−70.9	----					5	17,520	−63.6	----	18	17,557	−62.7	----
60																									9	19,348	−62.4	----

[1] Data not yet received.

[2] Elevation changed from 15 to 19 meters on Nov. 9, 1949.

(*) Temperature and relative humidity data for this level are not available or are available only for certain days. See note entitled "Change in Summarization of Radiosonde Data," p. 6, in the January 1946 issue of the MONTHLY WEATHER REVIEW.

NOTE.—All observations scheduled between 0300 and 0500, G. C. T. except at Ciudad Victoria, Mazatlan and Merida, where they are taken near 0200, G. C. T. "Number of observations" refers to those of dynamic height only. (In a few cases temperature or humidity data may be missing for one or more standard pressure surfaces of some observations.) Relative humidity data are not published for standard pressure surfaces having a corresponding mean temperature below −20° C. Relative humidity data beginning with Oct. 1, 1948, are computed and expressed in these tables on the basis of the vapor pressure over water. Upper air values of relative humidity at levels with temperatures less then 0° C. have formerly been computed and expressed on the basis of the vapor pressure over ice. All relative humidity observations are obtained by electric hygrometer and have been adjusted to compensate for the values occurring below the operating range of the humidity element. For explanation of the adjustment see article entitled "Curve Method for Obtaining Monthly Means of Relative Humidity," p. 241, MONTHLY WEATHER REVIEW, December 1944.

None of the means included in these tables are based on less than 15 observations at the surface or 5 observations at a standard pressure level.

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 2200 G. C. T. during November 1949. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second*

Altitude (meters) m. s. l.	Abilene, Tex. (534 m.)			Albuquerque, N. Mex. (1,627 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (505 m.)			Boise, Idaho (868 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (100 m.)			Charleston, S. C. (16 m.)			Cincinnati, Ohio (273 m.)			El Paso, Tex. (1,198 m.)			Ely, Nev. (1,910 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	264	1.7	30	218	0.8	30	286	3.6	30	252	4.5	30	300	4.9	28	336	1.1	30	134	1.8	27	262	2.0	25	184	1.8	30	272	3.3	29	244	4.7	30	268	1.0	30	305	1.3
500							30	283	4.6										30	134	1.8	27	253	4.4	25	217	4.3	30	266	5.1	29	248	6.7								
1,000	30	249	2.5				30	284	6.0				30	299	7.2	28	306	.6	29	215	1.0	24	246	8.1	25	240	6.0	28	272	7.0	29	254	8.3								
1,500	30	268	3.3				29	287	7.7	30	265	9.4	29	304	9.8	28	195	2.0	27	290	1.1	18	252	12.0	18	260	7.9	28	278	9.4	27	268	11.1	30	269	1.4			
2,000	30	277	4.3	30	258	1.6	29	289	10.0	30	282	11.8	29	308	12.0	28	232	3.2	25	338	3.2	11	254	11.7	12	271	9.6	28	281	10.8	25	274	12.4	30	297	2.1	30	293	1.3
2,500	30	286	5.7	30	299	3.8	26	294	12.0	30	289	13.4	27	308	13.0	27	256	4.9	23	337	4.6				10	266	11.3	26	281	12.3	21	276	14.1	30	300	2.6	30	253	1.8
3,000	30	293	6.9	30	307	6.2	25	295	13.4	29	291	13.6	26	308	14.0	27	265	7.0	22	332	5.4							25	276	13.8	17	276	15.6	30	304	3.5	29	273	2.7
4,000	29	303	8.8	29	311	7.1	24	284	16.4	25	301	16.1	23	305	16.9	23	275	10.3	21	322	6.5							22	272	17.0	14	292	15.4	28	314	4.4	29	294	5.1
5,000	27	303	8.7	29	307	7.2	22	281	19.7	23	303	20.5	18	312	19.0	23	280	13.0	21	311	6.4							18	270	18.1	11	292	17.5	28	310	4.7	26	288	7.8
6,000	23	314	10.6	29	306	8.6	16	278	19.5	19	304	21.4	16	314	21.1	20	273	13.5	19	302	9.0							16	266	20.7	11	294	19.3	28	316	5.7	24	288	9.1
8,000	21	305	11.8	25	313	10.6										11	278	11.4	15	277	14.8							10	262	25.9				25	326	6.7	19	277	10.6
10,000	19	310	16.7	20	309	11.7													13	280	19.0												19	310	8.8	11	270	12.2
12,000	14	286	15.7	16	306	11.9																											11	302	11.1			
14,000				10	306	13.3																																

Altitude (meters) m. s. l.	Grand Junction, Colo. (1,475 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jacksonville, Fla. (16 m.)			Joliet, Ill. (178 m.)			Las Vegas, Nev. (663 m.)			Little Rock, Ark. (88 m.)			Medford, Oreg. (416 m.)			Miami, Fla. (12 m.)			Mobile, Ala. (66 m.)			Nashville, Tenn. (182 m.)			New York, N. Y. (15 m.)			Oakland, Calif. (8 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	287	0.7	30	259	2.8	30	261	4.8	29	286	2.0	30	255	3.7	30	131	0.4	30	258	4.7	28	270	0.1	30	28	0.9	30	302	1.8	30	252	2.8	29	300	2.1	29	268	2.0
500				30	254	4.1				29	274	4.1	30	261	5.7				30	258	4.7	28	135	.1	30	18	1.8	30	292	3.4	30	241	4.4	29	273	4.4	29	23	.9
1,000				30	263	5.9	30	263	7.9	29	277	5.1	28	267	7.4	30	90	.2	30	272	5.6	28	175	1.9	30	351	1.7	28	311	4.8	29	253	5.9	25	270	6.8	29	302	.8
1,500	30	282	.8	29	277	7.8	30	271	11.2	28	281	7.6	22	266	10.9	30	348	1.3	30	283	7.6	27	198	5.1	29	308	2.0	26	316	7.8	25	271	8.4	25	277	8.9	29	266	1.4
2,000	30	276	1.0	27	283	10.4	30	281	12.6	25	288	9.8	19	274	12.6	30	336	1.2	29	294	10.5	25	215	6.4	27	302	2.7	26	308	9.5	25	271	8.4	20	269	10.7	29	239	2.2
2,500	30	268	2.0	25	285	11.5	29	292	13.7	25	287	10.9	15	271	11.9	30	347	.8	28	301	13.0	22	216	8.5	26	291	4.0	26	304	10.5	23	284	11.8	17	264	12.9	27	224	2.5
3,000	29	289	3.9	23	285	13.4	25	295	12.9	25	277	12.3	12	282	14.4	30	63	.4	27	303	15.1	20	225	9.8	25	262	5.5	24	293	11.7	21	283	14.2	11	278	9.7	26	242	3.2
4,000	27	308	8.1	20	281	15.0	14	306	11.9	24	276	14.7				30	270	1.4	24	303	17.1	17	238	11.3	25	260	8.2	22	292	13.4	21	288	15.8				26	236	4.2
5,000	27	312	11.4	19	281	16.7	11	304	13.2	23	270	16.8				28	267	2.2	22	304	18.3	16	232	15.8	20	256	9.7	18	287	15.0	19	285	17.8				25	245	6.2
6,000	26	307	13.4	16	283	18.5				22	263	18.6				27	269	1.6	19	307	18.9	14	222	14.6	16	261	12.9	14	280	16.6	18	286	18.5				24	244	7.2
8,000	22	304	15.9							13	268	24.7				26	273	2.6	11	306	20.1				11	264	21.8				17	289	20.6				22	243	10.0
10,000	14	298	13.3													26	287	3.1													10	292	19.7				14	240	8.6
12,000																23	292	5.1																				
14,000																19	282	6.4																				
16,000																11	274	4.4																				

Altitude (meters) m. s. l.	Oklahoma City, Okla. (396 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)			Rapid City, S. Dak. (982 m.)			St. Cloud, Minn. (318 m.)			St. Louis, Mo. (181 m.)			San Antonio, Tex. (240 m.)			San Diego, Calif. (13 m.)			Sault Ste. Marie, Mich. (221 m.)			Seattle, Wash. (116 m.)			Spokane, Wash. (725 m.)			Washington, D. C. (24 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	266	2.2	30	302	4.1	30	133	0.6	30	312	6.4	27	294	3.2	30	259	3.6	30	222	1.8	29	288	2.8	28	328	0.5	27	202	3.3	26	201	1.9	29	261	2.3
500	30	266	2.2	30	303	4.7	30	101	.7				27	299	5.0	30	266	5.8	30	222	1.8	29	284	1.7	28	263	1.1	27	199	6.2				29	264	4.3
1,000	30	277	3.0	29	299	7.1	30	88	1.6	30	312	6.5	25	302	7.9	30	269	8.2	30	245	1.8	28	145	1.1	23	271	3.7	25	213	8.4	26	208	4.7	27	271	7.1
1,500	30	294	6.3	29	308	9.8	30	102	2.4	30	305	9.7	23	311	10.4	28	282	11.8	30	275	3.4	27	98	2.7	16	286	5.1	21	217	8.7	24	220	7.3	26	276	9.3
2,000	30	306	9.1	27	312	12.2	30	105	1.7	30	304	11.4	19	310	12.7	25	287	13.6	29	287	4.2	27	90	2.8	12	286	5.5	20	215	9.8	19	233	7.5	25	277	11.9
2,500	30	298	10.5	27	310	13.3	30	90	.7	30	305	14.0	17	312	13.7	23	286	15.0	29	299	5.1	27	109	2.5				16	218	10.0	19	254	7.3	23	273	13.9
3,000	30	297	11.8	27	310	14.5	30	227	.6	30	308	15.9	14	317	15.2	22	295	16.1	29	307	5.8	26	107	1.7				13	219	9.2	17	268	6.1	20	272	15.5
4,000	30	305	13.7	25	312	18.0	29	201	1.4	22	306	15.5	11	320	16.5	18	292	17.0	28	314	7.6	24	139	2.3				10	230	12.1	13	260	8.4	14	262	17.3
5,000	28	315	16.5	23	313	20.6	26	185	.9	18	298	18.8				17	298	18.1	28	307	8.2	20	130	3.0							11	261	11.4	12	262	18.8
6,000	27	311	17.1	19	311	23.0	26	204	.8	15	298	18.0				13	296	19.0	28	305	9.7	20	126	2.4												
8,000	23	312	17.4				24	195	3.2							10	305	20.2	22	303	10.8	20	118	2.3												
10,000							22	234	3.0										17	283	12.6	12	193	4.0												
12,000							17	289	3.1																											

TABLE 3.—*Free-air resultant winds based on rawin observations made near 0300 G. C. T. during November 1949. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second*

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,636 m.)			Big Spring, Tex. (774 m.)			Bismarck, N. Dak. (505 m.)			Brownsville, Tex. (7 m.)			Caribou, Maine (191 m.)			Charleston, S. C. (13 m.)			Columbia, Mo. (237 m.)			Grand Junction, Colo. (1,473 m.)			Greensboro, N. C. (275 m.)			Hatteras, N. C. (3 m.)			International Falls, Minn. (358 m.)			Little Rock, Ark. (80 m.)			Medford, Oreg. (401 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	84	0.7	30	158	2.4	29	310	2.6	30	138	2.4	30	306	2.1	30	244	2.3	30	271	2.0	30	42	0.5	30	268	2.9	30	246	4.1	30	286	1.4	30	263	5.9	30	170	1.2
500										30	138	2.4	30	286	3.0	30	268	6.2	30	274	5.5				30	267	6.0	29	270	8.1	30	277	2.4	30	263	5.9	30	168	1.3
1,000				30	194	3.3	29	308	9.6	29	256	.6	30	276	4.1	29	275	6.5	30	292	8.4				30	273	8.2	29	268	7.9	30	298	5.1	30	276	7.7	30	182	2.7
1,500				30	250	3.7	29	313	13.2	29	335	1.7	30	264	5.4	28	272	6.9	30	299	10.3	30	42	.5	29	283	8.2	29	265	8.5	30	310	8.0	30	278	8.4	30	203	4.4
2,000	30	310	3.6	30	279	4.8	27	314	14.1	29	347	3.0	30	264	6.5	28	276	8.2	30	305	11.7	30	279	.6	29	283	9.3	28	261	9.9	30	313	9.8	28	295	9.6	30	221	6.9
2,500	30	316	5.3	30	293	5.7	25	312	14.6	27	338	3.4	30	264	8.3	28	278	9.9	30	305	12.1	30	267	2.3	29	281	11.3	28	259	11.8	30	316	11.5	27	294	11.9	30	238	9.1
3,000	30	312	5.6	30	298	6.9	24	315	15.0	28	323	4.3	30	257	10.4	27	272	12.1	30	308	13.4	30	288	3.6	29	273	12.9	27	259	13.3	30	318	13.2	26	292	13.2	30	238	10.7
4,000	30	321	6.2	30	311	6.8	20	318	17.7	28	309	5.9	30	253	13.9	27	264	14.8	30	304	16.8	29	320	7.8	28	276	17.3	27	256	17.9	26	320	14.0	22	298	13.7	30	244	12.4
5,000	30	314	7.3	30	318	8.4	16	315	15.6	28	295	6.1	30	243	18.4	24	259	15.4	29	304	18.6	29	313	11.3	28	267	19.9	25	257	20.1	24	318	17.3	22	298	17.1	28	246	13.9
6,000	30	314	8.3	30	312	7.8	15	304	15.8	27	287	7.9	29	244	19.8	19	256	18.1	25	306	19.8	28	310	12.3	25	267	21.3	21	254	21.5	23	322	17.5	20	297	17.2	26	241	15.2
8,000	26	333	10.0	28	309	8.8	13	296	17.9	27	264	12.8	22	244	23.4	11	246	22.2	19	299	18.1	23	308	15.3	18	267	26.3	13	267	27.6	18	324	16.9	14	292	16.6	20	243	14.3
10,000	25	321	11.4	27	304	10.3	10	298	21.1	26	263	21.0	18	242	27.0				14	313	18.1	18	323	14.1							15	300	19.6	10	302	15.3	18	235	18.4
12,000	21	319	9.6	21	297	12.5				19	255	21.4	12	242	21.5				12	301	19.3	15	318	15.0														
14,000	10	307	10.8	16	284	13.6				15	248	19.1										12	321	13.7														
16,000										10	248	13.3																										

Altitude (meters) m. s. l.	Miami, Fla. (12 m.)			Nantucket, Mass. (14 m.)			Nashville, Tenn. (180 m.)			New Orleans, La. (6 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (392 m.)			Rapid City, S. Dak. (980 m.)			San Antonio, Tex. (242 m.)			San Juan, P. R. (28 m.)			St. Cloud, Minn. (318 m.)			Santa Maria, Calif. (72 m.)			Sault Ste. Marie, Mich. (221) m.)			Spokane, Wash. (726 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	3	1.2	29	270	1.0	30	234	1.2	29	284	3.3	30	243	0.2	26	224	1.4	30	293	5.0	30	148	0.9	30	127	1.0	30	293	1.5	30	62	0.7	29	74	0.6	30	158	1.2
500	30	36	1.3	29	263	5.1	30	256	5.7	29	284	3.3	30	349	.3	26	224	1.4				30	148	.9	29	97	4.4	30	296	3.7	30	29	2.4	29	176	.5			
1,000	30	25	1.0	28	262	7.2	30	272	8.8	28	305	4.0	30	223	.6	26	283	5.2	30	293	5.2	30	243	1.5	28	96	4.5	30	305	7.2	30	39	2.4	29	259	2.6	29	199	3.9
1,500	30	318	1.3	27	259	8.9	29	288	9.9	28	306	5.2	30	224	1.4	25	299	7.4	30	313	11.4	30	284	3.0	28	96	3.9	29	311	8.7	30	54	2.0	29	276	5.3	26	227	6.3
2,000	30	290	2.6	26	256	11.0	29	290	11.1	29	303	6.4	30	219	2.1	26	310	8.6	30	314	13.8	30	311	4.4	29	89	4.1	28	309	10.6	30	64	1.5	28	279	7.6	26	237	8.0
2,500	30	266	4.3	27	256	13.5	29	288	12.4	29	297	7.6	30	221	3.2	26	310	9.0	30	313	15.7	30	313	5.6	27	89	0.4	26	311	11.1	30	86	1.1	27	281	8.5	26	247	7.5
3,000	30	263	5.8	26	253	15.1	29	289	14.8	29	302	8.8	30	222	3.9	26	306	9.4	29	317	16.3	30	319	6.0	27	74	3.4	25	309	13.6	30	93	.6	26	287	9.3	25	261	8.1
4,000	28	260	6.9	25	250	18.1	29	287	17.6	29	301	10.5	30	234	5.0	26	310	10.5	23	309	14.9	30	316	7.7	26	67	2.5	23	308	16.0	30	273	.7	26	292	11.5	26	262	12.1
5,000	28	257	9.0	24	248	20.2	28	282	19.7	27	288	11.2	29	242	7.2	25	309	12.1	20	313	15.5	29	315	9.0	27	56	2.5	20	304	16.7	29	281	2.5	24	294	14.9	25	265	15.5
6,000	28	257	11.5	22	243	24.1	25	278	18.4	26	288	14.8	27	248	7.6	25	310	13.1	20	312	16.6	29	314	11.6	24	59	3.2	18	311	15.0	27	273	1.3	20	303	15.2	23	265	17.3
8,000	28	256	19.2	12	271	21.8	18	266	17.4	22	268	17.7	25	247	10.5	22	302	14.6	12	290	13.9	26	306	14.8	21	348	3.4	16	297	21.4	25	270	.7	17	304	16.7	17	257	14.4
10,000	27	253	26.1	11	264	24.5	12	269	18.2	15	266	22.6	21	246	9.8	18	309	16.4				22	302	17.9	19	327	9.2	12	299	24.8	25	263	2.7	12	295	18.7	12	254	14.3
12,000	20	250	30.4				11	265	22.3	10	262	25.4	18	252	6.6	16	307	19.3				17	287	23.5	18	323	14.1				24	243	4.0								
14,000													11	285	5.0	12	285	17.2				10	266	28.1	16	325	11.9				21	264	4.4						
16,000																									12	351	5.2				13	256	3.2						

Altitude (meters) m. s. l.	Tatoosh Island, Wash. (33 m.)		
	Observations	Direction	Speed
Surface	28	100	4.3
500	28	157	7.1
1,000	25	186	7.7
1,500	25	196	8.3
2,000	25	211	9.6
2,500	25	217	11.3
3,000	25	224	13.2
4,000	24	229	16.1
5,000	22	234	18.7
6,000	23	240	22.1
8,000	18	239	25.1
10,000	12	235	23.8

NOTE.—Resultants prepared from rawins at high altitudes are biased toward lower wind speeds. Values appearing in this table should therefore be used with caution when the number of observations missing is greater than three. See note following Table III in the June 1948 issue of the MONTHLY WEATHER REVIEW.

RIVER STAGES AND FLOODS FOR NOVEMBER 1949

Severe floods occurred in the Pacific Northwest during the latter part of November causing the loss of several lives and considerable damage. Very little flooding occurred elsewhere in the United States. It was quite a contrast to 1 year ago when floods were much more general and severe.

Atlantic Slope drainage.—Precipitation averaged below normal along the Atlantic Slope during November except in the extreme northern portion and at a few scattered points. It was the driest November since 1936 in portions of the Delaware and Schuylkill River Basins with stages remaining low throughout the month.

Heavy rains (3 to 4 inches) occurred over eastern North Carolina from October 29 through November 1, causing overflows on the Cape Fear, Neuse, and Roanoke Rivers.

The heavy rains over the Yadkin-Pee Dee River Basin on the 1st caused light flooding on the Pee Dee River at Cheraw and Pee Dee, S. C., but no property damage occurred.

Ohio Basin.—Flood stage was reached but not exceeded on the West Branch of the Monongahela at Weston, W. Va., on the 29th due to heavy rains (1.75 inches) over the headwaters on the 28th. The French Broad River exceeded flood stage slightly at Asheville, N. C., on the 1st and 2d due to heavy rains on October 31 and November 1.

Flood stages were reached on the Tennessee River at Whitesburg, Ala., and on the South Chickamauga Creek at Chickamauga, Tenn., due to the heavy rains during the last week in October. No damages resulted.

Puget Sound and Washington Coast drainage.—The worst flood in 28 years occurred in the lower Skagit Valley from the 27th to the 28th. It was due to heavy rains that began on the 23d, continuing through the night of the 26–27th. During the 5-day period 11.2 inches of rain were recorded in the upper Skagit, with 4.5 inches of it occurring during the last 24 hours. Snow-melt was not an appreciable factor and rainfall averaged considerably less than 1 inch per day in the lower valleys. All of the streams in western Washington were near or somewhat above flood stage by the 27th, but extensive damage occurred only in the lower Skagit Valley. One of the hardest hit towns in this valley since 1921 was Hamilton. In the Snohomish Valley, this flood was the greatest since 1934. Considerable damage resulted and several lives were lost.

FLOOD STAGE REPORT FOR NOVEMBER 1949

[All dates in November unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest[1]	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE	*Feet*			*Feet*	
Roanoke:					
Weldon, N. C.	31	1	5	38.8	3
Scotland Neck, N. C.	28	3	7	31.4	5
Williamston, N. C.	10	4	14	11.6	9
Neuse:					
Neuse, N. C.	14	2	5	16.5	4
Smithfield, N. C.	13	2	6	15.7	5
Cape Fear:					
Fayetteville, N. C.	35	3	3	36.4	3
Lock No. 2, Elizabethtown, N. C.	20	1	6	28.5	4
Pee Dee:					
Cheraw, S. C.	30	2	4	34.0	2
Pee Dee, S. C.	19	4	10	21.3	7
MISSISSIPPI SYSTEM					
Ohio Basin					
West Fork: Weston, W. Va.	17	29	29	17.0	29
French Broad: Asheville, N. C.	6	1	2	7.3	1
WEST GULF OF MEXICO DRAINAGE					
Sabine:					
Mineola, Tex.	14	Oct. 25	2	17.4	Oct. 29
Gladewater, Tex.	26	Oct. 30	7	31.8	2
PACIFIC SLOPE DRAINAGE					
Columbia Basin					
Santiam: Jefferson, Oreg.	13	27	28	14.6	28
Chehalis Basin					
Satsop: Satsop, Wash.	34	27	27	34.6	27
Chehalis: Grand Mound, Wash.	12.5	28	29	13.4	28
Puget Sound					
Snoqualmie: Tolt, Wash.	51.5	27	28	54.2	28
Snohomish: Snohomish, Wash.	24	13 27	13 28	23.8 27.5	13 27
Skagit:					
Concrete, Wash.				[2] 40.7	27
Mount Vernon, Wash.	22	27	28	27.7	28
Nooksack: Deming, Wash.	25	27	27	26.7	27

[1] Provisional.
[2] Highest of record.

CLIMATOLOGICAL DATA FOR NOVEMBER 1949

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

[For description of tables and charts, see Review, January 1943, p. 15]

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature								Precipitation					
			Monthly extremes								Greatest monthly		Least monthly	
	Section average	Departure from the normal	Station	Highest	Date	Station	Lowest	Date	Section average	Departure from the normal	Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	52.9	−1.4	5 stations	83	[1] 11	Gadsden	18	26	0.80	−2.39	Arley	3.34	Chatom	T
Arizona	55.3	+5.4	3 stations	95	[1] 3	Fort Valley	8	12	.33	−.63	Sedona	1.03	5 stations	0.00
Arkansas	52.3	+1.0	Magnolia	85	28	2 stations	12	22	.37	−3.45	Lee Creek	1.17	11 stations	.00
California	56.5	+4.5	Bonita	100	3	3 stations	9	[1] 5	1.68	−.36	Gasquet R. S.	8.80	5 stations	.00
Colorado	42.9	+7.8	Box Ranch	86	8	Platoro	−7	12	.24	−.55	Wolf Creek Pass	2.20	8 stations	.00
Florida	62.1	−2.9	3 stations	90	[1] 1	Milton Exp. Sta	26	[1] 19	1.86	−.35	Royal Palm Ranger Sta.	7.17	Okeechobee 9 W	.30
Georgia	53.1	−2.3	2 stations	84	12	Blairsville Exp. Sta	15	23	1.08	−1.61	Washington	3.29	Fort Gaines	T
Idaho	40.9	+5.6	do.	77	[1] 4	Grouse	1	11	1.87	−.08	Wallace	7.38	Grand View	.02
Illinois	44.2	+1.8	5 stations	80	[1] 10	Marengo	3	26	.67	−1.93	Mackinaw	1.93	2 stations	T
Indiana	42.7	+.2	Vincennes	81	11	Angola	9	26	1.12	−1.93	La Porte	4.35	Moores Hill	T
Iowa	41.7	+4.3	2 stations	79	[1] 7	New Hampton	6	22	.49	−1.23	Belle Plaine	1.27	6 stations	.00
Kansas	48.9	+5.8	Coldwater	88	10	Atwood	9	21	.15	−1.10	Horton	1.51	20 stations	.00
Kentucky	45.4	−1.1	Beaver Dam	80	11	Shelbyville 2 W	11	22	1.82	−1.62	Delphia	4.10	Covington WB AP	.43
Louisiana	58.2	−.7	Camp Polk	89	24	Tallulah	21	22	.34	−3.76	Atchafalaya	2.00	11 stations	.60
Maryland-Delaware	45.8	+.4	Coleman, Md	83	11	2 stations	12	33	1.68	−.99	Friendsville, Md	3.71	Clear Spring, Md	.58
Michigan	35.1	−.9	Dowagiac 2 E	72	12	3 stations	−11	26	2.25	−.24	Detour 1 N	5.47	Monroe Water Works	.68
Minnesota	34.4	+4.7	Winona	76	8	Hallock	−9	25	.94	−.25	Dawson	2.10	2 stations	.13
Mississippi	54.8	−.4	Picayune	86	[1] 11	Pontotoc	19	22	.39	−3.46	Pelahatchie	2.30	19 stations	.00
Missouri	47.6	+3.1	Camdenton	87	11	Black	10	22	.45	−2.28	Maryville	1.06	2 stations	.00
Montana	41.5	+9.8	3 stations	78	[1] 3	Lakeview	−2	11	.48	−.37	Heron 25 W	5.76	13 stations	.00
Nebraska	45.4	+8.1	Central City	82	11	Arthur	4	21	.17	−.62	New Port	1.05	15 stations	.00
Nevada	47.0	+7.1	Lathrop Wells	90	3	Imlay	5	17	.52	−.12	Glenbrook	2.34	3 stations	.00
New England	36.7	−1.4	3 stations	73	[1] 11	2 stations	−10	27	3.13	−.46	Eastport WB City Maine.	7.01	Rockwood Lake Conn	.86
New Jersey	43.8	−.1	Runyon	80	11	Layton	2	28	1.61	−1.65	Belle Plain	3.80	2 stations	.74
New Mexico	47.7	+4.8	2 stations	87	[1] 8	Selsor Ranch	−1	12	.07	−.54	Dulce	.73	91 stations	.00
New York	36.4	−1.9	do.	75	11	Gouverneur	−12	27	2.69	−.38	Buffalo WB Airport	6.37	2 stations	.83
North Carolina	49.4	−.7	New Bern	85	1	Mount Mitchell	7	22	2.87	+.07	Quebec	5.58	Hiwassee Dam	.84
North Dakota	37.1	+10.3	Oakes	75	7	Pembina CAA	−13	25	.30	−.31	Towner	1.19	6 stations	.00
Ohio	42.4	+.8	Hillsboro 1E	81	12	4 stations	10	[1] 22	1.47	−1.22	Geneva	4.75	Mount Healthy	.30
Oklahoma	53.1	+3.3	Wewoka	86	12	3 stations	15	22	.13	−1.89	South Grand Lake	.98	124 stations	.00
Oregon	44.9	+4.7	Prospect 2 SW	82	1	Fremont	6	19	3.84	−.04	Valsetz	22.09	Rome CAA AP	.23
Pennsylvania	40.6	−.8	2 stations	79	12	Kane 1 NNE	4	26	1.77	−1.13	Kregar 4 SE	5.30	Doylestown	.60
South Carolina	52.1	−1.9	Loris	85	1	Caesar's Head	15	19	2.28	−.08	Bishopville	5.45	Pellon	.27
South Dakota	42.4	+9.3	Long Valley	82	28	Deerfield Dam	4	21	.24	−.42	Milbank	1.48	9 stations	.00
Tennessee	47.6	−1.0	2 stations	80	10	6 stations	16	[1] 22	1.25	−2.40	Odomville	4.24	Memphis substation	.21
Texas	58.5	+1.4	McCook	98	29	Miami	18	21	.13	−1.99	Beaumont	2.24	328 stations	.00
Utah	43.1	+.60	Zion National Park	83	4	2 stations	6	[1] 12	.59	−.24	Alta	4.46	6 stations	.00
Virginia	46.5	+.3	3 stations	82	11	Big Meadows	11	22	2.02	−.49	Smithfield	4.78	Amissville	.46
Washington	44.7	+4.3	Kosmos	83	2	Bumping Lake	11	21	5.95	+.82	Quinault R. S.	28.84	Kennewick	1.00
West Virginia	42.2	+1.1	Morgantown No. 1	84	12	Cranberry	5	24	2.64	−.14	Le Page Greenbatton	5.27	Salem	.98
Wisconsin	35.5	+2.0	Blair	78	7	Crivitz Highfalls	−3	26	1.20	−.72	Shawano	4.22	Baraboo Water Works	.34
Wyoming	40.3	+8.9	Glenrock	80	6	Quaking Aspen Creek	−2	29	.36	−.42	Snake River	3.06	9 stations	.00
Hawaii	70.4	−1.8	Mahukona	89	12	Haleakala R. S.	32	16	6.34	−.17	Kukui	48.00	8 stations	.00
Puerto Rico	76.0	−.6	Caguas	97	2	Cidra	50	25	4.55	−2.45	Rio Blanco 1800'	14.00	San Francisco	.82

[1] Other dates also.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR NOVEMBER 1949

District and station	Elevation of instruments: Barometer above sea level[1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Temperature of the air: Averages: Mean minimum	Temperature of the air: Averages: Mean	Temperature of the air: Averages: Departure from normal	Temperature of the air: Extremes: Highest	Temperature of the air: Extremes: Date	Temperature of the air: Extremes: Lowest	Temperature of the air: Extremes: Date	Total heating degree days	Mean temperature of the dew point	Mean relative humidity[2]	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Greatest in 24 hours	Precipitation: Days with 0.01 inch or more	Precipitation: Days with thunderstorms	Precipitation: Total snowfall (unmelted)	Precipitation: Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Wind: Prevailing direction	Wind: Speed of fastest mile: Miles per hour	Wind: Speed of fastest mile: Direction	Wind: Speed of fastest mile: Date	Character of day (sunrise to sunset), number of days: Clear	Character of day (sunrise to sunset), number of days: Partly cloudy	Character of day (sunrise to sunset), number of days: Cloudy	Sky cover[3] tenths (sunrise to sunset)	Possible sunshine
NEW ENGLAND	Ft.	Ft.	Ft.	Mb.	Mb.	Mb.	°F.	°F.	°F.	°F.	°F.		°F.			°F.	%	In.	In.	In.			In.	In.	m.p.h.					0-8	4-7	8-10	0-10	%
Caribou[3]	628	5	33	987.5	1,011.7	----	32	18	25.2	−2.0	45	1	1	27	1,192	20	77	5.87	+3.2	1.09	18	0	32.2	8	11.4	nw.	44	w.	24	1	9	20	8.2	--
Eastport	75	67	82	1,007.8	1,010.8	−5.8	44	30	37.2	+.5	56	14	12	27	835	----	--	7.01	+3.7	1.26	13	0	2.8	0	11.0	----	52	ne.	4	3	6	21	8.1	31
Greenville, Maine	1,069	4	41	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Portland, Maine[3]	103	6	43	1,006.8	1,011.2	−6.8	46	27	36.3	−1.0	63	8	9	27	862	31	81	4.26	+.8	1.40	14	1	2.0	0	6.5	n.	40	se.	4	5	9	16	7.0	42
Concord[3]	289	5	45	1,000.3	1,011.5	−6.8	46	24	35.0	−.4	64	8	5	27	898	27	75	2.11	−1.0	.70	10	0	1.4	0	4.7	wnw.	29	w.	26	4	10	16	7.1	33
Mt. Washington	6,274	5	37	795.5	1,013.5	----	22	11	16.0	−3.6	34	10	−8	22	1,471	----	--	3.35	−3.1	1.08	18	0	12.4	8	32.5	----	----	----	----	4	6	20	7.7	27
Burlington[3]	403	6	51	995.9	1,011.5	−6.1	41	26	33.3	−3.3	58	3	2	27	750	28	82	2.62	.0	.73	18	0	8.1	T	8.9	s.	49	s.	23	4	3	23	8.1	28
Boston[3]	124	33	62	1,006.4	1,011.7	−6.3	51	36	43.5	+1.5	68	8	15	27	644	32	67	3.71	+.4	1.47	13	0	1.4	0	12.0	sw.	39	sw.	23	7	9	14	6.5	50
Nantucket[3]	12	4	34	1,010.5	1,011.4	−6.2	53	38	45.1	+.7	63	11	20	23	599	40	80	4.13	+.9	1.14	11	1	T	0	9.4	nw.	38	ssw.	25	6	5	19	7.2	31
Block Island	26	11	46	1,009.8	1,011.5	−6.5	52	40	46.2	+1.6	62	14	19	27	561	----	--	3.18	−.4	.80	13	0	1.6	0	17.4	----	61	ne.	2	8	9	13	6.2	44
Providence[3]	159	65	60	1,005.4	1,011.8	−6.5	52	35	43.6	+3.2	70	8	14	27	644	32	40	3.27	+.2	.75	6	0	2.0	0	8.7	sw.	43	sw.	23	7	11	12	5.9	44
Hartford[3]	159	5	44	1,005.8	1,012.2	−6.4	50	31	40.8	+1.3	70	8	15	27	728	33	74	2.74	−.8	1.01	13	1	3.9	T	8.1	n.	32	sw.	23	7	7	16	6.8	40
New Haven[3]	107	5	39	1,007.8	1,012.2	−6.8	51	34	42.6	+2.7	64	11	17	27	672	----	--	2.20	−.8	.50	11	3	1.3	0	7.3	----	----	----	----	12	7	11	5.4	53
MIDDLE ATLANTIC																																			
Albany[3]	97	6	40	1,007.8	1,011.6	−7.0	45	29	37.1	+.8	65	8	11	27	837	30	75	1.20	−1.3	.36	9	0	2.4	0	8.5	s.	35	w.	25	7	4	19	7.4	26
Binghamton[4]	871	57	79	980.7	1,012.1	−6.5	46	32	39.1	+.4	70	10	13	26	778	30	76	2.03	−.4	.77	19	0	4.0	0	5.8	sw.	23	sw.	8	5	6	19	7.4	33
New York[4]	314	415	454	1,000.3	1,012.4	−6.6	54	40	46.6	+2.4	74	11	24	28	552	33	62	1.07	−1.9	.31	7	0	.2	0	12.9	nw.	49	w.	20	9	10	11	5.6	36
Allentown[3]	385	4	58	998.3	1,013.1	----	51	31	40.6	−1.4	72	11	15	26	732	32	73	1.23	−1.6	.58	9	2	.8	0	8.3	wsw.	----	----	----	9	9	12	5.9	--
Harrisburg[3]	374	30	49	999.0	1,013.0	−7.0	52	35	43.4	+.6	73	8	24	26	650	32	66	.94	−1.3	.54	7	0	T	0	7.3	w.	34	nw.	20	9	8	13	6.1	54
Philadelphia[4]	114	174	150	1,011.5	1,013.0	−7.0	54	40	47.0	+1.3	74	11	24	27	541	34	67	1.03	−1.7	.35	7	0	T	0	9.6	sw.	24	n.	20	12	8	10	5.2	61
Reading	323	47	306	1,000.3	1,012.2	−7.8	52	36	44.4	+.5	73	11	23	27	622	----	--	1.53	−1.2	.57	7	1	.2	0	11.0	----	37	w.	20	7	12	11	5.9	51
Scranton	805	72	104	981.7	1,011.5	−7.8	48	33	40.4	−.1	70	11	16	27	740	----	--	1.61	−1.2	.64	11	0	1.8	0	6.5	----	30	nw.	22	8	6	16	6.3	48
Atlantic City	52	37	172	1,010.8	1,012.9	−6.7	55	41	48.5	+2.6	71	8	26	27	502	----	--	3.45	+.6	2.07	9	0	T	0	15.3	----	46	ne.	1	8	13	9	5.4	65
Newark[3]	30	5	46	1,011.2	1,012.5	----	53	35	44.2	+.2	75	11	22	23	622	32	65	1.15	−2.3	.25	8	0	.4	0	10.8	sw.	31	nnw.	26	8	10	12	5.7	--
Trenton	190	89	107	1,003.1	1,010.2	−9.1	52	36	44.2	−.2	72	11	21	27	622	----	--	.94	−1.8	.29	8	0	T	0	9.1	----	31	nw.	26	9	10	11	5.6	53
Baltimore[4]	123	100	215	1,008.5	1,013.6	−6.4	57	41	48.8	+2.5	77	11	27	23	488	35	63	1.13	−1.4	.74	7	0	T	0	9.8	nw.	39	w.	20	10	10	10	5.0	53
Washington[4]	112	56	100	1,009.1	1,013.7	−6.6	57	39	48.4	+3.2	77	11	28	23	502	34	61	.74	−1.6	.34	5	0	T	0	9.2	ssw.	29	w.	22	11	7	12	5.4	53
Cape Henry	18	8	54	1,012.5	1,013.2	−6.8	59	44	52.0	−.1	74	12	29	23	391	----	--	2.70	+.3	2.22	6	1	.0	0	13.2	----	52	nw.	1	15	10	5	3.9	68
Lynchburg[3]	686	5	58	975.7	1,014.4	−6.6	59	36	47.6	+2.4	75	11	21	23	523	31	59	1.20	−1.1	.54	8	1	T	0	8.9	sw.	43	nw.	30	15	9	6	3.9	71
Norfolk[4]	91	80	125	1,012.9	1,014.3	−6.4	61	44	52.8	+1.4	78	11	32	23	363	39	67	3.51	+1.4	3.20	7	1	.0	0	10.6	sw.	35	nw.	1	16	7	7	4.2	68
Richmond[4]	144	11	52	1,007.5	1,014.1	−6.6	61	40	50.6	+2.3	79	11	27	23	433	36	68	2.24	.0	1.52	7	1	.0	0	6.8	ssw.	27	w.	23	14	8	8	4.3	68
SOUTH ATLANTIC																																			
Asheville	2,253	77	92	941.4	1,016.5	−5.5	57	32	44.5	−.6	75	12	20	23	613	32	75	1.45	−.8	1.36	9	1	.8	0	7.9	nnw.	28	nw.	25	13	9	8	4.5	67
Charlotte[4]	779	63	86	987.5	1,015.7	−5.3	61	40	50.6	.0	77	12	30	19	431	36	64	2.37	−.2	1.19	16	0	T	0	6.9	ssw.	35	w.	29	16	8	6	3.8	72
Greensboro[3]	886	6	56	983.1	1,015.3	−6.0	60	34	47.0	+.3	79	12	24	19	541	34	64	1.60	−.9	.97	7	1	T	0	9.3	sw.	32	ne.	1	19	9	2	3.2	74
Hatteras	11	5	47	1,013.9	1,014.4	−5.6	63	49	55.8	−.5	75	13	36	23	277	48	74	2.41	−1.1	.88	6	3	.0	0	12.8	sw.	42	sw.	1	15	8	7	3.9	67
Raleigh[4]	376	5	71	999.0	1,013.4	−7.6	63	40	51.6	+.6	79	12	29	23	404	36	66	2.36	+.1	1.86	6	1	T	0	6.8	sw.	23	sw.	20	8	2	3.1	76
Wilmington	72	73	107	1,014.2	1,015.6	−5.4	65	44	54.6	−1.4	77	9	32	26	315	44	--	2.52	+.6	.71	4	1	.0	0	8.6	wsw.	29	sw.	25	23	2	5	2.3	80
Charleston[4]	48	11	92	1,014.6	1,016.4	−4.3	66	48	57.2	−.9	75	13	34	26	236	43	71	.75	−1.4	.45	6	2	.0	0	9.3	sw.	36	nw.	21	19	6	5	3.0	78
Columbia, S. C.[4]	347	70	91	1,007.8	1,016.0	−5.3	65	42	53.4	−.7	77	12	29	23	384	40	67	1.71	−.3	1.07	4	1	.0	0	7.9	sw.	24	w.	25	21	3	6	2.9	74
Greenville, S. C.[3]	1,040	18	36	978.0	1,015.6	−5.1	61	37	49.0	−.6	76	11	27	19	481	36	64	2.07	−1.1	1.11	6	2	.0	0	7.0	sw.	37	ne.	1	18	7	5	3.4	76
Augusta[3]	182	62	77	1,010.2	1,016.6	−4.1	66	42	54.4	−.6	78	11	30	22	320	38	57	.95	−1.5	.45	5	1	T	0	9.1	sw.	----	----	----	19	4	7	3.1	--
Savannah[3]	65	19	51	1,015.2	1,017.6	−3.1	68	44	56.4	−.4	78	28	30	19	260	44	67	.45	−1.6	.18	5	1	.0	0	12.2	ssw.	35	w.	25	18	6	6	3.1	76
Jacksonville[4]	43	86	110	1,016.9	1,018.1	−2.2	70	50	59.8	−2.4	79	12	38	26	168	46	68	2.50	+.5	1.91	7	1	.0	0	8.5	nw.	27	nw.	25	17	8	5	----	73
FLORIDA PENINSULA																																			
Key West[4]	21	10	64	1,016.3	1,017.0	−.3	77	68	72.3	−2.0	86	14	54	27	4	63	75	2.30	+.1	1.62	4	2	.0	0	9.4	n.	33	nw.	1	14	12	4	4.1	70
Miami[4]	25	242	249	1,015.9	1,016.8	−1.2	76	62	68.8	−3.7	85	10	47	26	31	58	71	.81	−2.4	.60	6	0	.0	0	13.2	n.	36	nw.	1	14	10	6	4.5	67
Tampa[3]	35	5	36	1,016.6	1,018.2	−1.1	74	53	63.6	−3.3	84	9	43	19	96	52	71	1.04	−.7	.92	4	0	.0	0	6.5	n.	25	s.	14	15	11	4	3.4	80
EAST GULF																																			
Atlanta[3]	1,173	33	72	975.3	1,017.3	−4.0	73	40	55.8	−.4	76	12	28	19	415	36	66	.62	−2.7	----	----	----	----	----	9.6	nw.	36	nw.	25	17	8	5	2.7	--
Macon[3]	370	79	87	1,004.4	1,017.6	−3.4	67	40	51.1	−.4	79	12	27	19	348	39	67	.86	−2.2	.77	5	1	.0	0	8.5	nnw.	31	w.	24	17	6	7	3.2	71
Apalachicola	35	11	51	1,017.3	1,018.3	−2.0	68	50	53.4	----	80	12	27	19	348	39	64	.77	----	.71	6	2	.0	0	8.6	nw.	25	nw.	25	19	6	5	3.6	75
Pensacola[4]	56	54	79	1,016.9	1,019.2	−1.5	69	49	59.4	−1.9	76	20	38	22	181	----	--	2.01	−1.1	1.59	5	0	.0	0	7.8	nw.	25	nw.	25	19	6	5	2.6	78
Anniston	618	6	32	995.6	1,018.3	−1.7	65	33	49.2	−1.0	77	29	35	22	200	46	--	1.29	−2.4	1.11	5	0	.0	0	7.2	nw.	26	nw.	25	20	7	3	2.6	82
Birmingham[3]	700	5	63	995.6	1,018.6	−3.1	65	37	50.8	−.6	78	11	25	22	430	38	65	.42	−2.9	.32	3	2	T	0	7.7	ssw.	29	nw.	25	21	4	5	2.9	73
Mobile[4]	57	86	161	1,011.2	1,019.3	−1.0	69	48	58.5	−.1	80	29	34	22	223	46	69	.12	−3.5	.07	2	0	.0	0	11.7	n.	38	nw.	25	17	10	3	2.7	81
Montgomery[4]	218	92	105	1,011.2	1,018.7	−2.6	67	44	55.8	.0	80	11	32	22	291	39	63	.25	−3.0	.14	3	2	T	0	6.8	nw.	23	n.	21	21	6	3	2.5	80
Meridian[4]	375	67	92	1,005.4	1,019.2	−2.1	69	37	52.8	−1.4	81	29	26	19	370	40	69	.73	−2.6	.58	3	1	.0	0	6.2	nw.	----	----	----	21	5	4	2.4	--
Vicksburg[4]	247	82	102	1,010.5	1,019.2	−2.1	68	47	57.8	+1.2	80	28	32	22	248	41	--	.04	−3.7	.03	2	0	.0	0	8.4	ssw.	26	sw.	28	23	2	5	2.2	84
New Orleans C. O.	53	76	84	1,017.3	----	----	71	53	62.0	+.4	83	11	39	22	135	----	--	.10	−3.0	.09	3	0	.0	0	6.6	----	20	ne.	21	22	7	1	2.2	86
New Orleans A. P.[3]	30	6	52	1,017.6	1,020.6	−.1	71	47	59.2	----	83	29	37	19	202	47	68	.21	----	.21	1	0	.0	0	9.7	s.	30	nne.	21	23	6	1	2.0	--
WEST GULF																																			
Shreveport[3]	181	5	64	1,009.5	1,019.7	−1.3	72	45	61.7	+2.7	85	28	29	22	241	47	63	.31	−2.5	----	----	----	----	----	9.1	ssw.	29	sw.	26	23	5	2	1.9	--
Fort Smith[3]	463	6	30	1,001.4	1,019.4	−.9	68	37	58.3	+1.8	82	11	23	22	384	36	70	.37	−3.3	.37	1	1	.0	0	6.9	ne.	30	sw.	10	24	4	2	2.0	90
Little Rock[3]	265	26	58	1,008.5	1,019.2	−1.5	67	41	52.4	+1.4	79	11	27	22	338	41	60	.72	−2.2	.72	2	2	.0	0	6.9	ne.	30	sw.	31	nw.	16	21	6	3	1.7	97
Austin[3]	621	5	41	998.0	1,020.6	+.6	77	48	62.6	+2.0	79	11	27	22	338	41	62	.28	−3.9	.28	1	1	.0	0	7.8	sw.	31	nw.	16	21	6	3	2.2	90
Brownsville[3]	20	5	54	1,017.3	1,019.0	+.7	80	57	68.7	+4.1	89	28	35	1	112	44	57	.01	−2.3	.01	1	0	.0	0	7.8	s.	30	ne.	21	22	7	1	1.9	88
Corpus Christi[3]	44	6	33	1,018.3	1,020.2	+.9	79	54	68.7	+1.5	92	29	43	1	19	56	69	.01	−2.3	.01	1	0	.0	0	9.6	sse.	32	nw.	12	20	9	1	2.5	76
Dallas[3]	488	34	45	1,000.7	1,019.3	−1.0	74	45	66.4	+3.6	95	29	39	1	49	55	72	T	−2.0	T	0	0	.0	0	9.2	sse.	38	s.	26	24	4	2	1.7	92
Fort Worth[3]	706	40	56	994.2	1,019.6	−.4	73	45	59.2	+2.8	85	19	32	22	200	40	54	.18	−2.4	.18	1	1	.0	0	8.0	s.	28	s.	27	27	2	1	1.3	97
Galveston[4]	54	122	129	1,019.3	1,020.4	+.1	71	60	58.8	+4.3	86	10	32	22	213	40	55	.09	−2.5	.09	1	1	.0	0	13.5	s.	37	nw.	12	23	6	1	1.5	--
Houston[4]	138	157	190	1,016.9	1,020.6	+.3	75	54	65.1	+1.8	78	11	48	1	62	54	72	.47	−2.9	.47	1	1	.0	0	9.0	nne.	29	ne.	21	24	5	1	1.6	86
Laredo[3]	418	10	38	1,003.7	1,019.4	----	82	53	67.8	+3.4	97	28	41	1	29	48	54	.09	−3.8	.09	1	0	.0	0	7.0	nne.	30	nw.	13	24	5	1	2.0	89
Palestine	510	64	72	1,001.4	----	----	72	50	67.8	+4.0	97	28	41	1	29	48	54	T	−1.2	T	0	0	.0	0	8.4	sse.	----	----	----	22	4	4	2.3	--
Port Arthur[4]	34	59	134	1,018.0	1,019.9	−.1	72	54	61.0	+3.8	84	28	35	22	167	----	--	.44	−3.0	.44	1	1	.0	0	7.3	s.	21	sw.	26	20	9	1	2.1	89
San Antonio[3]	794	6	51	994.2	1,020.2	+.6	78	48	62.6	+2.3	91	29	36	1	105	42	54	.13	−1.8	.13	1	1	.0	0	8.1	nw.	38	nw.	11	22	5	3	2.0	86

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR NOVEMBER 1949—Continued

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Mean minimum	Mean	Departure from normal	Temperature of the air: Extremes: Highest	Date	Lowest	Date	Total heating degree days	Mean temperature of the dew-point	Mean relative humidity [6]	Precipitation: Total	Departure from normal	Greatest in 24 hours	Days with 0.01 inch or more	Days with thunderstorms	Total snowfall (unmelted)	Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Prevailing direction	Speed of fastest mile: Miles per hour	Direction	Date	Character of day (sunrise to sunset), number of days: Clear	Partly cloudy	Cloudy	Sky cover' tenths (sunrise to sunset)	Possible sunshine
OHIO VALLEY AND TENNESSEE	*Ft.*	*Ft.*	*Ft.*	*Mb.*	*Mb.*	*Mb.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*		°*F.*			°*F.*	%	*In.*	*In.*	*In.*			*In.*	*In.*	m. p.h.					*0-3*	*4-7*	*8-10*	*0-10*	%
									45.1	+1.0							69	1.37	−1.9														5.2	
Chattanooga [3]	762	6	66	989.5	1,017.5	−4.2	62	34	47.6	−.3	76	11	23	23	521	35	67	1.02	−2.3	.52	4	1	T	0	5.2	nw.	32	nw.	21	16	8	6	3.8	63
Knoxville [3]	995	27	71	981.4	1,017.1	−4.2	59	35	47.0	+.5	76	12	27	6	542	36	68	1.51	−1.6	.92	5	4	T	0	9.4	nw.	33	nw.	24	13	8	9	4.6	69
Memphis [3]	399	5	49	1,007.5	1,018.0	−3.0	64	38	51.2	+1.1	78	11	22	22	425	38	63	.69	−3.6	.69	1	1	.0	0	9.1	ssw.	31	nw.	24	25	0	5	1.9	86
Nashville [3]	546	5	72	997.6	1,017.6	−4.7	60	36	48.1	−.9	77	11	22	22	508	37	68	.54	−3.0	.28	2	1	T	0	8.1	s.	31	sw.	21	16	7	7	3.9	65
Lexington [3]	989	4	58	979.3	1,015.8	−4.2	54	34	44.2	−.6	75	11	19	22	625	33	69	2.53	−.8	1.12	9	1	.6	0	13.2	ssw.	---	---	---	15	3	12	5.0	--
Louisville [3]	525	5	54	998.0	1,015.4	−5.3	56	37	46.6	+1.6	77	12	22	22	558	34	64	1.56	−2.0	.63	8	2	T	0	9.7	ssw.	29	sw.	16	13	5	12	5.1	59
Evansville [3]	431	6	40	1,000.0	1,016.2	−4.8	57	35	46.2	+1.8	77	12	21	22	570	34	69	.97	−2.8	.75	6	2	T	0	9.6	wnw.	30	nw.	24	12	9	9	4.3	75
Indianapolis [3]	823	5	54	984.1	1,014.0	−6.0	51	34	42.3	+1.6	75	10	22	22	682	33	72	.89	−2.5	.53	6	0	T	0	13.1	sw.	40	nw.	13	10	5	15	5.8	51
Terre Haute [3]	575	4	36	993.6	1,014.8	−5.2	52	33	43.0	+.6	74	10	18	22	662	34	72	1.28	−2.0	1.08	6	1	.1	0	12.0	ssw.	31	nw.	13	12	6	12	5.1	64
Cincinnati [4]	627	135	148	991.5	1,014.7	−6.0	55	39	47.2	+2.6	75	11	26	22	536	33	69	.71	−2.1	.35	9	0	.1	0	12.2	sw.	17	nw.	4	11	5	14	5.6	49
Columbus [4]	822	90	110	983.4	1,013.8	−6.5	51	36	43.8	+1.9	73	12	21	22	636	32	71	1.21	−1.6	.62	8	1	T	0	10.8	sw.	37	w.	13	8	3	19	6.7	41
Dayton [3]	1,003	6	55	977.0	1,013.8	−6.2	50	34	42.0	+1.6	71	12	19	22	691	32	72	.48	−2.4	.14	8	1	T	0	13.4	ssw.	41	w.	30	10	3	17	6.2	49
Elkins [3]	1,947	5	45	941.8	1,015.1	−6.6	50	29	39.7	+.4	77	12	15	23	760	31	74	3.71	+.9	1.64	12	2	7.8	0	7.7	wsw.	34	nw.	20	7	5	18	6.9	42
Parkersburg	637	77	84	---	---	---	54	36	45.2	+1.4	77	12	20	22	594	---	---	1.54	−1.0	.74	8	2	T	0	7.6	------	29	nw.	30	8	5	17	6.5	35
Pittsburgh [3]	842	39	54	981.7	1,012.8	−7.2	50	35	42.2	+1.0	74	12	20	22	679	32	70	1.92	−.4	.59	13	3	5.1	0	11.6	ssw.	30	sw.	23	7	5	18	7.1	33
LOWER LAKES									38.9	.0							77	2.63	−.2														7.9	
Buffalo [3]	768	34	96	982.4	1,011.2	−6.8	44	32	38.0	−.5	66	10	15	26	811	32	79	6.37	+3.4	2.51	22	4	28.6	T	12.8	sw.	49	s.	13	2	4	24	8.5	19
Canton	448	10	61	993.9	1,010.5	−6.8	39	24	31.4	−3.6	59	8	−9	28	1,011	---	---	3.26	+1.1	.74	17	0	9.6	2	7.5	------	24	sw.	23	4	6	20	7.7	31
Oswego	335	71	85	998.0	1,010.5	−7.5	44	32	38.1	−1.3	67	10	11	26	810	---	---	3.23	−.2	.56	23	1	4.8	0	9.9	------	34	w.	23	2	3	25	8.8	30
Rochester [3]	523	4	69	991.5	1,011.3	−7.0	44	31	37.4	−1.3	72	10	13	26	822	32	83	3.30	+.8	.60	21	2	6.1	0	10.3	wsw.	35	sw.	13	0	8	22	8.4	22
Syracuse [3]	596	5	57	988.5	1,011.5	−7.1	45	31	38.0	+.8	69	10	9	26	809	31	77	2.32	−.7	.57	22	0	6.5	0	9.9	w.	34	w.	23	2	5	23	8.5	20
Erie [4]	714	57	81	---	---	---	47	36	41.5	+.1	68	10	21	26	705	---	---	3.34	.0	.78	20	1	7.4	0	9.1	------	28	w.	23	3	5	22	8.2	23
Cleveland [3]	762	27	54	983.4	1,011.9	−7.1	49	34	41.3	+2.3	74	12	16	22	710	34	76	2.73	+.1	.99	16	1	16.0	T	13.0	sw.	36	w.	30	5	2	23	7.6	30
Sandusky	629	5	67	988.8	---	---	49	36	42.5	+1.4	70	10	17	22	675	---	---	1.24	−1.2	.26	13	1	2.0	0	10.0	------	30	w.	30	4	6	20	7.5	37
Toledo [3]	628	5	47	988.5	1,012.0	−7.3	48	32	40.0	+1.3	68	10	11	26	755	32	76	1.06	−1.3	.41	8	1	1.1	0	12.3	sw.	33	nw.	23	4	5	21	7.4	36
Fort Wayne [3]	857	5	34	980.7	1,012.7	−6.6	48	32	40.3	+1.5	71	12	18	22	742	33	76	.90	−2.0	.41	7	1	T	0	10.2	sw.	28	nw.	30	7	3	20	6.9	39
Detroit [3]	730	5	77	984.1	1,011.6	−7.0	45	33	39.0	−.2	66	10	10	26	782	32	75	1.23	−1.2	.56	13	0	5.5	0	11.8	sw.	36	nw.	30	4	7	19	7.7	30
UPPER LAKES									35.2	+.8							77	1.65	−.8														7.6	
Alpena	609	5	89	987.1	---	---	41	29	34.7	+.3	62	7	9	26	910	---	---	2.05	−.6	.66	17	0	10.7	1	11.0	------	36	se.	26	2	5	23	8.4	21
Escanaba	612	51	72	987.5	---	---	40	28	34.4	+1.3	62	7	15	22	907	---	---	1.94	−.2	1.29	9	1	8.4	1	11.7	------	37	n.	2	3	7	20	7.4	34
Grand Rapids [4]	707	70	244	985.1	1,011.0	−7.0	45	33	39.2	+.8	68	9	15	26	776	31	80	1.01	−1.8	.29	13	2	9.9	0	11.8	ssw.	36	s.	1	7	4	19	7.2	32
Lansing [4]	878	5	90	978.0	1,011.4	−6.6	43	29	36.0	−1.2	67	10	−5	26	871	30	80	1.60	−.9	.67	14	1	12.1	1	14.5	sw.	36	w.	23	4	6	20	7.7	24
Marquette	734	44	73	982.1	---	---	38	28	33.4	+.1	68	7	15	24	951	---	---	3.21	+.3	.82	21	0	35.2	6	9.3	------	42	sw.	28	2	5	23	8.3	16
Sault St. Marie [3]	614	10	52	982.4	1,009.8	−6.8	37	23	30.0	−.4	59	7	1	26	1,050	25	81	2.41	−.6	.99	15	1	15.4	4	9.1	e.	31	nw.	23	2	5	23	8.5	36
Chicago [3]	673	5	38	989.8	1,012.4	−6.2	48	32	40.1	+2.4	71	10	15	22	745	30	71	.89	−1.6	.42	6	1	2.6	0	12.0	w.	36	s.	1	8	5	17	6.5	44
Green Bay	617	5	32	987.5	1,010.8	−6.1	41	26	33.6	−.4	68	7	10	26	938	26	74	1.50	−.7	.62	9	1	5.4	1	10.7	nw.	56	sw.	22	5	6	19	7.2	44
Milwaukee [3]	681	33	66	985.4	1,011.2	−6.8	45	31	38.2	+2.3	68	7	10	26	801	30	72	.62	−1.2	.33	6	0	3.1	T	14.0	wnw.	43	sw.	1	5	8	17	7.2	34
Duluth [4]	1,133	5	47	958.3	1,010.8	−6.1	39	27	32.6	+2.6	66	7	12	21	972	25	81	1.30	−.2	.64	9	0	12.2	2	19.9	wnw.	37	nw.	1	7	8	15	7.1	37
NORTH DAKOTA									36.9	+10.6							74	.38	−.3														5.7	
Fargo [3]	940	5	47	977.0	1,012.3	−6.0	43	25	34.1	+7.0	65	3	2	25	925	28	79	.79	−.1	.25	10	0	5.3	T	13.8	nnw.	45	n.	26	10	4	16	6.1	44
Bismarck [3]	1,677	5	41	952.6	1,014.0	−5.3	52	26	39.1	+12.6	70	5	6	21	776	28	68	.20	−.4	.13	3	0	2.2	0	12.0	nw.	56	nw.	26	12	6	12	5.1	62
Devils Lake	1,478	11	44	958.0	---	---	43	25	33.9	+9.4	68	6	4	21	931	---	---	.55	−.2	.29	7	0	5.4	T	9.5	------	34	nw.	26	8	5	17	6.2	52
Grand Forks [3]	832	4	41	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Williston	1,878	42	50	945.8	---	---	52	29	40.6	+13.4	69	3	15	21	728	---	---	T	−.6	T	0	0	T	0	8.8	------	47	w.	23	9	8	13	5.5	70
UPPER MISSISSIPPI									42.0	+3.8							70	.63	−1.4														5.8	
Minneapolis-St. Paul [3]	919	43	74	977.3	1,011.6	−5.7	44	30	37.2	+4.8	67	7	18	21	836	28	73	.42	−.8	.19	7	1	2.7	0	12.5	nw.	36	nw.	14	6	8	16	6.8	37
La Crosse [3]	672	5	29	986.8	1,011.8	------	46	27	36.6	+2.9	72	7	11	25	851	28	72	.67	−.9	.28	8	1	3.5	0	9.7	nw.	34	nw.	13	6	7	17	7.0	43
Madison [3]	974	27	39	979.7	1,011.8	−6.5	46	28	36.9	+2.7	70	7	9	25	842	28	72	1.04	−.7	.75	6	1	2.7	0	13.8	w.	49	sw.	22	6	8	16	7.0	38
Charles City	1,015	10	51	975.3	1,012.9	−5.7	48	29	38.6	+5.6	74	7	18	22	792	---	---	.75	−.8	.39	6	0	2.6	0	7.3	------	21	nw.	19	7	11	12	5.7	47
Moline [3]	606	6	50	990.9	1,013.7	−5.3	51	32	41.8	+4.3	72	7	18	22	695	31	66	.71	−1.1	.45	3	1	.5	0	11.8	w.	34	sw.	22	11	5	14	5.8	47
Des Moines [4]	860	5	99	982.7	1,014.5	−4.1	54	33	43.5	+5.1	75	7	20	22	643	30	69	.55	−.9	.44	5	3	T	0	11.2	nw.	---	---	---	11	11	8	4.9	71
Dubuque	699	60	79	986.8	1,012.2	−6.4	49	32	40.7	+3.7	72	7	16	22	729	30	71	.83	−.9	.46	4	0	3.6	0	6.3	------	28	nw.	30	7	9	14	6.5	50
Burlington [3]	702	4	36	988.2	1,014.5	−4.5	54	32	43.1	+4.5	76	11	16	22	659	32	74	.47	−1.6	.28	4	1	.2	0	14.8	sw.	43	nw.	16	13	5	12	5.1	62
Cairo	357	5	99	1,003.4	---	---	59	40	49.5	+2.2	75	10	26	22	466	---	---	.79	−2.9	.74	2	1	T	0	9.8	------	29	sw.	19	15	12	3	3.3	74
Peoria [3]	609	7	26	991.9	1,013.8	−5.8	52	33	42.3	+2.5	74	11	16	22	682	32	68	.65	−1.7	.32	4	1	.3	0	13.5	wnw.	42	w.	30	10	6	14	5.4	54
Springfield, Ill. [4]	636	5	49	991.5	1,014.4	−4.9	54	34	44.0	+4.1	75	11	17	22	630	33	70	.43	−2.1	.26	3	2	.2	0	15.7	nw.	34	s.	9	12	6	12	5.0	66
St. Louis [4]	568	33	59	988.8	1,015.2	−4.1	59	39	49.2	+3.8	80	11	25	22	480	32	62	.25	−2.6	.21	12	1	T	0	10.8	wnw.	35	s.	9	16	9	5	3.4	79

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR NOVEMBER 1949—Continued

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Temperature of the air: Averages: Mean minimum	Temperature of the air: Averages: Mean	Temperature of the air: Averages: Departure from normal	Temperature of the air: Extremes: Highest	Temperature of the air: Extremes: Date	Temperature of the air: Extremes: Lowest	Temperature of the air: Extremes: Date	Total heating degree days	Mean temperature of the dew point	Mean relative humidity [2]	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Greatest in 24 hours	Precipitation: Days with 0.01 inch or more	Precipitation: Days with thunderstorms	Precipitation: Total snowfall (unmelted)	Precipitation: Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Wind: Prevailing direction	Wind: Speed of fastest mile: Miles per hour	Wind: Speed of fastest mile: Direction	Wind: Speed of fastest mile: Date	Character of day (sunrise to sunset), number of days: Clear	Character of day (sunrise to sunset), number of days: Partly cloudy	Character of day (sunrise to sunset), number of days: Cloudy	Sky cover [3] tenths (sunrise to sunset)	Possible sunshine
	Ft.	Ft.	Ft.	Mb.	Mb.	Mb.	°F.	°F.	°F.	°F.	°F.		°F.			°F.	%	In.	In.	In.			In.	In.	m. p.h.					0–3	4–7	8–10	0–10	%
MISSOURI VALLEY																	63	.34	−1.1														3.3	
Columbia, Mo. [4]	784	6	66	986.5	1,015.4	−4.2	60	37	48.3	+4.2	83	11	21	22	512	33	68	.50	−1.7	.45	2	2	T	0	9.9	ssw.	42	nw.	12	17	8	5	3.0	84
Kansas City [3]	963	38	76	988.2	1,016.0	−3.6	61	39	49.8	+6.1	81	11	26	18	459	32	56	.21	−2.0	.21	2	2	T	0	11.5	s.	43	sw.	11	18	9	3	2.9	82
St. Joseph [3]	967	5	51	980.0	1,015.6	−3.7	60	34	47.0	+5.5	78	11	22	22	541	30	62	.61	−1.0	.61	2	2	.0	0	11.9	nw.	38	nw.	24	19	9	2	2.4	86
Springfield, Mo. [3]	1,324	5	50	968.8	1,017.1	−2.9	60	35	47.6	+2.6	78	11	19	22	530	34	67	1.04	−1.8	1.04	3	2	.0	0	9.5	s.	38	nw.	24	17	9	4	3.1	85
Topeka [4]	987	65	87	983.7	1,016.4	−2.9	61	37	49.1	+6.3	79	11	24	22	478	32	64	.72	−.8	.71	1	1	T	0	10.3	nw.	39	nw.	13	15	13	3	3.3	86
Lincoln [4]	1,189	6	81	971.9	1,015.7	−3.6	59	35	46.9	+7.8	74	7	23	18	546	30	63	.01	−1.1	.01	1	0	0	0						15	10	5	3.4	--
Norfolk, Nebr. [3]	1,551	5	38	959.0	1,015.4	------	58	30	43.6	+7.2	76	7	15	18	643	28	62	.06	−1.0	.06	1	0	T	0	12.2	nw.	45	nw.	24	15	13	2	3.2	73
Omaha [3]	1,105	5	68	974.6	1,016.9	−2.7	58	30	44.2	+9.6	72	6	18	21	591	28	60	.04	−1.0	.04	1	0	.0	0	9.7	------	33	nw.	1	16	9	5	3.8	87
Valentine	2,598	46	54	924.1	1,016.9	−2.4	58	33	45.2	+6.9	75	7	18	18	624	25	56	.27	−.3	.14	2	0	T	0	10.9	nw.	45	nw.	13	16	8	6	3.8	83
Sioux City [3]	1,138	5	40	972.9	1,014.8	−4.5	56	28	42.3	+8.3	74	7	18	21	679	28	68	.04	−1.0	.04	1	0	T	0	13.5	nw.	59	nw.	26	13	9	8	4.3	75
Huron [3]	1,301	5	41	966.5	1,014.4	−4.9	53	28	40.6	+9.1	72	6	18	21	733	28	68	.29	−.3	.27	3	0	T	0									5.4	
NORTHERN SLOPE																	58	.33	−.3														5.4	50
									43.0	+10.3							48	.03	------	.03	1	0	T	0	13.1	sw.	56	nw.	24	10	9	11	6.2	--
Billings [3]	3,570	16	39	892.3	1,017.1	−3.6	59	36	47.4	+12.0	71	4	23	20	525	26	48	.03	------	.03	1	0	T	0	8.0	s.	----	------	---	7	9	14	5.5	--
Butte	5,533	44	58	832.4	1,023.0	------	53	23	38.4	+9.1	68	5	11	21	799	24	60	.53	+.1	.36	3	0	T	0						9	9	12	5.5	--
Glasgow	2,086	34	53	940.1	1,015.9	------	55	25	40.4	+12.7	70	3	15	21	743	26	60	.02	−.5	.02	1	0	T	0	18.9	sw.	72	sw.	25	9	7	14	5.7	70
Great Falls [3]	3,657	16	75	888.9	1,016.1	------	57	38	47.5	+11.4	70	2	22	20	524	26	47	.05	−.6	.04	2	0	T	0	10.1	sw.	54	sw.	27	11	10	9	5.1	59
Havre	2,507	11	67	926.2	1,016.3	−3.0	56	30	42.9	+11.7	69	6	15	21	662	----	----	.03	−.6	.01	3	0	T	0	5.6	w.	44	sw.	27	7	9	14	6.2	64
Helena [3]	4,124	5	43	876.1	1,021.0	+.3	52	28	39.8	+8.0	66	1	13	20	754	27	66	.15	−.3	.06	4	0	2.0	T	3.5	se.	40	w.	27	5	4	21	7.4	35
Missoula [3]	3,263	4	32	905.9	1,022.2	+1.5	48	28	38.0	+6.6	62	1	17	18	811	31	82	.72	−.2	.32	8	0	2.3	T	7.0	s.	----	------	---	5	4	21	7.8	--
Kalispell	2,973	48	56	915.0	1,020.2	−.5	45	32	38.4	+6.0	59	25	23	21	797	33	--	1.42	+1.1	.43	10	0	.0	0	9.9	wnw.	----	------	---	11	10	9	5.1	--
Miles City [3]	2,371	5	28	931.3	1,016.9	−3.8	56	30	42.9	------	72	27	19	21	664	27	--	.02	------	.02	1	0	T	0	16.8	wnw.	57	nw.	1	11	13	6	4.6	70
Rapid City [3]	3,259	5	56	901.5	1,016.8	−3.5	60	32	46.0	+11.4	75	3	14	21	569	26	54	.15	−.3	.10	2	0	T	0	16.1	w.	50	w.	27	17	6	7	3.9	87
Cheyenne [3]	6,094	22	40	813.4	1,018.1	−1.5	58	32	45.2	+10.4	70	3	16	21	595	22	46	.02	−.5	.02	1	0	T	0	6.7	------	42	sw.	27	16	6	8	4.0	73
Lander [3]	5,352	6	30	831.7	1,020.6	−1.4	56	29	42.6	+12.3	67	25	19	30	672	23	53	.01	−.6	.01	1	0	T	0	8.0	s.	84	sw.	27	12	8	10	5.0	70
Sheridan [3]	3,790	5	38	885.5	1,018.3	−2.0	60	31	45.4	+12.7	76	3	16	21	585	26	56	.94	+.3	.82	6	0	T	0	8.7	nw.	43	nw.	11	20	5	5	3.0	78
North Platte [3]	2,821	11	51	917.0	1,017.4	−2.6	62	32	46.8	+10.2	73	7	16	21	550	28	62	.48	.0	.48	1	0	T	0									2.4	
MIDDLE SLOPE																	51	.01	−1.1														3.3	81
									51.0	+7.5							38	T	−.6	T	0	0	T	0	7.8	s.	35	n.	11	15	10	5	3.2	83
Denver [4]	5,292	106	113	838.8	1,018.2	−.8	64	38	50.9	+11.1	74	25	27	21	425	20	38	T	−.4	T	0	0	T	0	5.7	w.	42	n.	11	18	5	7	3.2	83
Pueblo [3]	4,690	5	36	859.1	1,019.0	−.6	66	29	47.4	+9.1	80	19	18	21	530	22	45	T	−1.0	T	0	0	.0	0	8.6	------	54	n.	11	21	6	3	2.6	94
Concordia	1,392	50	58	966.1	1,016.6	−3.4	61	37	49.0	+7.6	75	7	22	21	485	28	53	T	------	T	0	0	.0	0	11.5	n.	47	nw.	11	21	8	2	2.4	96
Dodge City [3]	2,509	5	58	928.9	1,017.8	−2.2	65	36	50.1	+7.5	77	19	18	21	442	30	56	.01	−.7	.01	1	0	.0	0	12.4	nw.	47	nw.	11	20	8	3	2.3	93
Wichita [3]	1,358	52	64	967.8	1,016.9	−2.4	63	38	50.8	+6.0	78	11	25	22	426	32	54	.06	−1.3	.06	1	0	.0	0	13.2	s.	43	n.	11	22	7	2	2.0	92
Oklahoma City [4]	1,214	10	47	970.9	1,019.0	−1.0	67	43	55.0	+6.2	80	10	30	22	305	36	53	T	−1.9	T	0	0	.0	0	9.0	s.	43	sw.	9	23	5	3	1.5	98
Tulsa [3]	674	10	60	992.9	1,018.4	------	68	40	53.6	+4.7	83	10	23	22	356	36	56	.01	−2.0	.01	1	1	.0	0									1.8	
SOUTHERN SLOPE																	48	T	−1.2														1.7	96
									56.7	+5.0							46	.00	−1.4	.00	0	0	.0	0	11.8	ssw.	42	w.	12	23	5	2	2.2	92
Abilene [3]	1,755	4	59	956.7	1,019.0	−.6	74	43	58.6	+6.0	88	27	34	13	214	35	44	.01	−.9	.01	1	0	.0	0	10.2	sw.	47	n.	11	23	4	3	2.2	90
Amarillo [3]	3,604	5	42	891.3	1,019.0	−.3	69	37	52.8	+9.0	81	28	28	21	367	28	44	T	−1.2	T	0	0	.0	0	6.0	nw.	27	nw.	12	24	6	0	1.3	90
Del Rio	960	63	71	984.4	1,019.3	+.3	78	48	62.6	+2.6	95	28	38	1	94	43	58	T	−.8	.01	1	0	.0	0	6.1	sw.	40	sw.	11	22	3	5	2.2	89
Roswell [3]	3,614	6	29	895.0	1,020.2	+1.2	72	33	52.5	+4.4	83	27	22	22	374	25	41	.01	−.8	.01	1	0	.0	0	12.9	ssw.	56	nw.	11	24	5	1	1.5	--
Wichita Falls [3]	1,030	4	49	981.0	1,019.0	------	72	42	57.1	+3.0	87	19	34	22	250	36	50	.00	−1.7	.00	0	0	.0	0									2.5	
SOUTHERN PLATEAU																	38	.22	−.5														1.7	94
									58.6	+6.5							44	T	−.5	T	0	0	.0	0	7.8	n.	40	w.	11	25	2	3	2.7	87
El Paso [3]	3,916	35	85	890.6	1,019.9	+1.9	71	40	55.7	+4.6	78	28	32	13	277	28	35	.00	−.5	.00	1	0	.0	0	4.8	n.	38	n.	11	20	5	5	2.7	87
Albuquerque [3]	5,314	5	45	849.3	1,020.4	+1.8	66	36	50.7	+7.4	74	4	29	12	426	22	47	.86	−.4	.86	1	0	3.0	0	5.7	nnw.	----	------	---	16	6	8	3.7	--
Flagstaff	6,907	34	48	795.8	------	------	62	28	44.8	+7.6	70	25	22	23	604	23	47	.30	−.4	.30	1	1	.0	0	2.9	e.	27	w.	10	21	3	6	2.9	87
Phoenix [4]	1,107	39	87	977.7	1,016.4	+1.7	82	50	66.2	+6.5	90	3	42	12	30	39	45	.17	−.6	.12	0	0	.0	0	8.0	ese.	33	e.	21	23	5	2	2.0	94
Tucson [3]	2,555	5	39	928.5	1,016.3	+1.4	80	49	64.3	+6.6	86	5	37	12	56	26	26	T	------	T	0	1	.0	0	5.2	nne.	31	nw.	10	22	3	5	2.1	96
Yuma [3]	142	9	54	101,.80	1,015.4	−.9	85	55	69.8	------	92	3	47	11	7	34	30																		

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR NOVEMBER 1949—Continued

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Mean minimum	Mean	Departure from normal	Temperature of the air: Extremes: Highest	Date	Lowest	Date	Total heating degree days	Mean temperature of the dew-point	Mean relative humidity [6]	Precipitation: Total	Departure from normal	Greatest in 24 hours	Days with 0.01 inch or more	Days with thunderstorms	Total snowfall (unmelted)	Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Prevailing direction	Speed of fastest mile: Miles per hour	Direction	Date	Character of day (sunrise to sunset), number of days: Clear	Partly cloudy	Cloudy	Sky cover [7] tenths (sunrise to sunset)	Possible sunshine
MIDDLE PLATEAU	Ft.	Ft.	Ft.	Mbs.	Mbs.	Mbs.	°F.	°F.	°F.	°F.	° F.		° F.			° F.	%	In.	In.	In.			In.	In.	m. p. h.					0-3	4-7	8-10	0-10	%
									43.6	+5.7							62	.64	−.1														4.0	
Ely [2]	6,262	8	41	814.4			60	23	41.4	+8.7	71	3	14	11	705			.42	−.2	.42	1	0	1.1	0	10.5		43	se.	9	16	6	8	4.0	79
Reno [2]	4,527	20	52	866.9	1,022.0	+1.0	64	24	44.2	+4.5	77	3	18	5	619	28	64	1.28	+.6	1.23	3	0	1.0	0	3.0	ssw.	47	s.	9	16	8	6	4.0	79
Winnemucca [2]	4,339	5	56	873.0	1,022.3	−.1	64	24	43.6	+5.2	74	2	15	22	638	26	56	.46	−.2	.40	4	0	.1	0	7.0		42	sw.	9	13	8	9	4.5	76
Salt Lake City [3]	4,357	32	58	877.4	1,023.8	+2.5	57	31	44.3	+4.9	68	26	26	22	624	34	72	.88	−.3	.87	3	0	T	0	7.5	sse.	37	se.	10	15	8	7	4.1	79
Grand Junction [2]	4,602	5	26	867.3	1,024.6	+5.0	58	30	44.4	+5.1	65	2	24	12	620	26	56	.15	−.4	.15	2	0	T	0	5.4	e.	26	se.	10	19	4	7	3.3	85
NORTHERN PLATEAU																																	5.6	
									43.7	+5.4							76	2.01	+.2														6.0	62
Baker [4]	3,471	36	54	900.4	1,023.2	+.8	55	31	43.0	+7.0	69	4	22	21	660	28		1.43	+.4	.69	6	0	.0	0	6.3	se.	27	sw.	27	9	7	14	6.0	62
Meacham	4,056	7	28	879.4	1,021.2		53	36	44.4		68	1	26	21	619	32	68	5.31		1.76	11	0	4.9	0	6.3	ese.				8	6	16	6.4	
Boise [2]	2,739	5	49	925.2	1,022.8	−.2	55	34	44.6	+4.9	70	27	22	22	613	34	69	1.40	+.1	.56	6	1	T	0	7.4	se.	37	nw.	27	8	10	12	5.5	63
Lewiston	1,436	4	23	908.5	1,020.9		54	37	45.2		65	25	29	18	592	38	79	1.42		.40	11	0	.0	0	5.6	e.				5	4	21	7.3	
Pocatello [2]	4,478	5	31	868.3	1,023.5	+1.5	55	30	42.4	+8.3	65	6	21	21	677	30	68	.76	−.3	.32	7	0	T	0	6.8	sw.	42	w.	27	12	6	12	5.0	67
Ellensburg [2]	1,735	5	58	956.7	1,020.3		50	31	40.8	+4.6	64	2	26	21	727	36	88	1.92	+.4	.52	13	0	T	0	4.0	e.				5	6	19	7.5	
Spokane [2]	1,929	6	51	950.2	1,020.3	−1.0	48	34	41.2	+2.7	59	5	26	21	713	36	83	2.28	+.2	.50	14	1	3.2	0	8.4	ne.	54	sw.	27	6	3	21	7.5	31
Walla Walla	991	57	65	984.1	1,020.3	−1.0	55	41	47.8	+5.0	70	27	34	7	518			2.05	.0	.49	11	1	.0	0	5.0	s.	30	sw.	27	5	7	18	7.2	35
Yakima [2]	1,076	4	54	980.4	1,020.0	−1.3	55	32	43.5	+5.4	69	2	26	18	641	36	80	1.50	+.3	.77	11	0	.0	0	6.9	w.				5	5	20	7.4	
NORTH PACIFIC COAST																																	7.9	
									49.8	+5.3							83	6.02	+.4														8.1	
Kelso [2]	750	38	76				58	40	49.3		69	5	31	1	467	44	84	5.14		1.16	18	0	.0	0	8.9	sse.				2	6	22		
North Head	211	5	55	1,008.1	1,015.6	−2.4	58	49	53.2	+5.0	74	1	42	9	356			9.90	+1.4	2.06	20	1	T	0	16.4	s.	65	s.	26	3	4	23	8.2	28
Seattle [4]	125	90	321	1,015.2	1,016.6	−2.0	57	46	51.5	+4.7	70	3	40	21	405	46	87	5.95	+.9	1.37	16	1	.0	0	8.8	s.	41	s.	26	1	9	20	8.3	25
Tacoma	194	172	201	1,009.5	1,016.6	−1.7	56	45	50.8	+6.2	69	4	40	7	421			5.72	−.5	1.48	20	1	.0	0	7.3	s.	39	sw.	26	2	9	19	7.8	25
Tatoosh Island	86	5	61	1,011.2	1,014.5	−2.1	55	47	51.0	+5.1	64	2	44	9	422	47	87	15.78	+3.8	2.94	21	3	T	0	21.1	e.	67	s.	26	2	1	27	9.1	12
Burns	4,162	35	47	877.1	1,021.7		57	29	43.0	+7.8	70	1	20	22	661	30	64	.64	−.7	.31	5	0	.8	0						11	4	15	5.6	
Eugene [3]	433	4	35	1,005.1	1,018.8		58	40	48.7		71	3	32	19	491	45	90	5.92		1.86	13	0	.0	0	6.3	s.				2	7	21	8.2	
Medford [2]	1,329	29	58	972.6	1,021.0	.0	57	35	45.7	+1.8	75	2	27	21	577	39	83	1.82	−.5	1.46	7	0	.0	0	4.9	se.				4	3	23	8.1	
Portland, Oreg. [4]	154	68	106	1,016.9	1,018.1	−1.5	60	46	52.8	+6.0	71	2	35	21	369	45	84	6.15	+.1	1.85	15	0	.0	0	6.2	se.	21	s.	26	4	5	21	7.7	44
Roseburg	510	45	76	1,000.3	1,019.4	−.9	61	43	51.7	+5.8	72	24	34	19	397			3.23	−1.4	1.09	12	0	.0	0	3.1	nw.	33	s.	11	3	6	21	8.0	26
MIDDLE PACIFIC COAST																																	5.7	
									57.4	+3.7							72	1.61	−1.5														7.4	49
Eureka	60	72	88	1,017.6			62	47	54.4	+3.3	69	17	42	4	317			3.23	−2.0	1.28	10	2	.0	0	5.6		24	s.	8	2	8	20	7.4	49
Red Bluff [2]	353	5	26	1,006.4	1,018.8	−1.5	72	45	58.3	+4.5	93	1	39	20	209	40	60	.94	−2.0	.90	3	0	.0	0	6.9	nw.	40	se.	9	11	5	14	5.3	75
Sacramento [4]	66	92	115	1,016.9	1,019.0	−.3	68	46	57.1	+3.5	83	4	41	22	238	46	75	1.10	−.8	1.00	4	0	.0	0	7.1	nnw.	23	s.	9	9	11	10	5.2	68
San Francisco [4]	155	112	132	1,018.6	1,018.9	−.4	67	52	59.8	+3.5	80	4	47	2	161	50	80	1.18	−1.2	1.04	5	0	.0	0	7.7	nw.	30	s.	9	14	8	8	4.9	67
SOUTH PACIFIC COAST																																	3.1	
									63.1	+5.5							68	1.27	+.3														4.1	78
Fresno [2]	327	5	34	1,007.5	1,018.9	−.7	72	43	57.4	+5.0	89	5	38	27	236	46	75	.46	−.5	.34	4	1	.0	0	4.3	e.	26	sw.	9	17	5	8		
Los Angeles [4]	338	236	263	1,013.9	1,016.9	−.7	79	56	67.2	+6.3	95	3	48	22	66	48	66	2.18	+1.0	2.07	2	0	.0	0	5.2	w.	23	w.	10	20	7	3	2.6	86
San Diego [2]	87	20	55	1,013.9	1,016.6	−.3	76	53	64.6	+5.3	92	4	47	24	80	47	62	1.16	+.4	1.10	3	0	.0	0	4.3	n.	34	sw.	10	22	3	5	2.6	79
WEST INDIES																																		
San Juan, P. R.	82	9	54				83	73	78.2	−.2	85	4	71	18	0			3.37	−3.4	.60	17	0	.0	0										
ALASKA																																		
Anchorage [2]	132	6	44	993.6	998.6		33	19	26.0	+3.6	50	21	7	26	1,172	22	81	.62	−.4	.27	8	0	8.2	T		ne.	42	e.	19	2	5	23	8.5	
Annette Island	113	5	53	1,002.0	1,006.1		50	41	45.3	+4.7	63	2	31	10	590	43	89	13.54	+2.5	2.30	27	0	T	0	13.8	se.				0	4	26	9.3	
Barrow	29	5	27	1,008.8	1,009.1		11	2	6.4	+6.4	30	2	−21	29	1,745	−1	73	.21	−.1	.08	8	0	1.6	5	17.1	ene.	41	ne.	22	1	7	22	8.6	
Bethel [2]	28	5	31	992.9	994.2		30	21	25.6	+8.8	45	21	−2	30	1,183	24	90	1.22	+.2	.27	16	0	11.8	T		n.	30	ene.	21	2	8	20	8.1	
Cordova [2]	45	5	32	997.0	999.0		41	28	34.2	+3.8	58	22	9	29	929	33		12.12	+3.2	3.28	23	0	9.0	4		e.	42	e.	22	2	4	24	8.7	
Fairbanks [2]	455	5	63	984.8	1,001.7		18	5	11.4	+8.0	47	19	−20	30	1,610	9	85	.36	−.4	.20	7	0	5.7	2		nw.	26	e.	19	4	6	20	7.7	
Galena	139	4	66	994.6	999.3		20	6	12.8	+12.4	36	19	−27	30	1,567	8	75	.78	+.2	.27	15	0	9.0	12	7.6	n.				1	9	20	8.0	
Gambell	32	5	32	995.6	996.6		27	22	24.5	+2.1	37	22	5	30		21	87	2.62	+1.6		12	0	18.1	4	2.5	nne.	45	n.	26	2	0	28	9.0	
Juneau [2]	80	6	30	1,003.1	1,004.0		43	35	39.3	+7.3	56	2	23	12	770	37	91	9.22	+3.8	3.34	26	0	1.0	0		ese.	34	se.	13	1	3	26	9.4	
Kotzebue [2]	20	5	31	999.3	1,000.0		21	12	16.3	+10.4	38	21	−21	29	1,460	14	85	.76	+.4	.26	9	0	8.2	7		ese.				0	7	23	6.9	
McGrath [2]	341	5	31	985.8	998.6		22	10	15.8	+12.6	47	21	−26	30	1,475	11	78	2.02	+.9	1.30	14	0	16.7	9	3.2	ese.				0	4	26	9.1	
Nome [2]	22	10	75	995.9	996.6		29	19	24.1	+8.2	44	20	−3	29	1,228	20	83	.98	.0	.33	13	0	10.5	2		n.	68	e.	16	1	3	26	8.9	
Northway [2]	1,718	5	32	940.1	1,004.7		9	−4	2.2	+4.4	26	1	−30	30	1,880	1	84	.05	−.3	.04	2	0	.9	7						3	7	20	7.9	
St. Paul Island	28	4	39	991.2	992.2		36	28	32.2	−.2	42	7	11	30	983	29	85	4.00	+1.2	81	22	0	3.4	1						0	8	22	8.5	
Yakutat	31	5	50	1,000.3	1,001.4		42	32	36.8	+2.1	53	22	23	12	850	36	94	12.15	−3.4	1.51	23	0	3.4	2						1	2	27	9.0	
HAWAII																																		
Honolulu [4]	38	86	98	1,017.3	1,018.0		77	69	73.4	−1.1	80	26	65	21	0	62	67	1.16	−2.7	.43	12	0	.0	0	12.3	ene.	26	ne.	12	7	15	8	5.2	66
PACIFIC AREA																																		
Canton Island	12			1,009.1	1,009.5		89	78	83.5		93	3	76	17	0		70	.02		.01	2	0	.0	0						3	19	8	5.8	
Wake Island	13			1,015.6	1,015.9		84	76	80.2		87	4	70	15	0		78	2.75		.78	18	3	.0	0	13.9	e.				9	17	4	4.8	

[1] Height of barometer cistern above mean sea level on Jan. 1, 1900, or when station was first established since Jan. 1, 1900. When station is moved to new location or airport, the pressure is reduced to the original elevation for homogeneity. These elevations do not represent the present station elevation in most cases.

[2] Data are from airport records. Pressures adjusted to original elevations according to note 1.

[3] Barometric, hygrometric, wind, character of day, and average cloudiness data from airport records; remainder from city office records.

[4] Barometric and hygrometric data from airport records, remainder from city office records.

[5] Barometric, temperature, degree day, and hygrometric data from airport; remainder from city office records.

[6] As of Jan. 1, 1949, relative humidity values at temperatures below 32° F. are expressed with respect to water rather than with respect to ice, as used prior to that date. Therefore, these hygrometric values before and after Jan. 1, 1949, cannot accurately be combined without necessary conversion.

[7] As of Jan. 1, 1949, "Sky cover" has been substituted for "Average cloudiness" to include smoke, snow, etc., in addition to clouds that obscure the sky.

NOTE.—Unless otherwise indicated, data in table are city office records.

SEVERE STORMS FOR NOVEMBER 1949

[The table hereunder contains such data as has been received concerning severe storms that occurred during the month]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Carteret County, N. C.	1	Afternoon				Winds	Damage to boats and fishing nets expected to run into thousands of dollars. Several small boats sunk. A commercial boat dashed against highway bridge and damaged completely.
San Francisco Bay Area, Calif.	9	A. m.				Rains and winds	Heavy rains and strong winds caused floods in some districts of Marin and San Mateo Counties. Strong winds blew down power lines and snapped trees. Manhole covers pushed up throughout San Francisco, and minor floods in virtually all areas of city. Basement rooms in some districts flooded. Gushing water stalled traffic through Ferry Terminal Underpass in San Francisco. At Edgemar a pick-up truck blown across highway and plunged down 25-foot bank. Sliding dirt and sand cut traffic at scattered points. Numerous plate glass windows broken by falling branches, etc.
St. Joseph, Mo.	11	8:28 p. m.		0	$30,000	Tornado	Two large warehouses demolished. Roof of 1 small building blown off and portion of another building blown down. Damage to above property $25,000; $3,000 to light wires and $2,000 to telephone lines. Debris carried ½ mile. No cloud observed due to darkness, but apparently a tornado. Heavy rain, thunderstorm, hail, and gusts up to 52 m. p. h. at Weather Bureau Office, 3 miles north of storm damage.
Winneconne (near), Wis.	12	7:45 a. m.		1		Electrical	Duck hunter on Lake Poygan struck and killed by lightning.
Illinois, central portion	13	5:20–6:15 p. m.			20,000	Wind	Brief but violent wind squalls hit several localities in Sangamon, Logan, Macon, Christian, Shelby, and Moultrie Counties. Major damage to new aluminum corn storage bins, about 100 bins being damaged or destroyed. Several trees downed in Springfield, breaking communication wires and damaging an automobile.
Pierson, Volusia County, Fla.	14	3:20 p. m.		0	40,000	Tornado	Moved north or northeastward; broke plate glass in a store front, wrecked some packing sheds and ferneries. No injuries to persons.
Ohio, northeastern counties	17–18				7,000	Snow	Numerous traffic accidents; 9 inches of snow at Cleveland, 8 at Elyria, and 6 at Chardon.
Hackneyville (near), 8 miles west of Alexander City, Tallapoosa County, Ala.	24	4:30 p. m.	100	10	3,000	Tornado	Near Hackneyville, in Camp Ground community, over path about 3 miles long. Storm moved eastward, destroyed 2 houses. 1 house, in which were 10 persons, was lifted into the air and smashed into second house about 150 yards away, killing all 10 occupants. 10 other persons were in second house which was also destroyed, but they were unhurt.
Fairview-Easley-Oneonta-Tate's Gap, Blount County, Ala.	24	5:15–5:30 p. m.	100	4	131,000	do	Storm moving eastward reported first at Fairview, west of Easley which is 6 miles west of Oneonta. 3 persons killed at Easley and another died as result of injuries when storm hit northern outskirts of Oneonta. Tornado moved to Tate's Gap before lifting, making a path about 15 miles long. 44 persons injured. 84 buildings damaged, of which 32 completely destroyed. $5,000 worth of crops in storage and $1,000 worth of livestock included in total.
Henagar, De Kalb County, Ala.	24	6 p. m.	100	2	10,000	do	Tornado moving eastward struck top of ridge at Henagar. 5 persons injured. 3 homes destroyed.
Bluefield, W. Va.	24	7:56–8:40 p. m.			5,000	Electrical	Tower of Radio Station WHIS struck by lightning, destroying tuning element and burning out power circuits; within transmitter house about 200 yards from tower, junction box for telephone connections burned out.
Great Falls, Mont.	25	7:27 a. m.				Wind	By 11:10 a. m. peaks of gusts reached 60 m. p. h.; frequent gusts of 75 m. p. h.; highest gust of 80 m. p. h. about 2:50 p. m. A few small buildings blown down; roofs of some houses and signboards damaged; 2 large windows blown out; a few planes damaged.
Underwood, McLean County, N. Dak.	25	Evening			5,000	do	Damage to roofs.
Washington, counties bordering Puget Sound on east, San Juan Islands, and south coast of Straits Juan de Fuca.	26–27	Early a. m. 26th and continuing.		4	50,000	Wind and rain	Sporadic, but widespread damage to roof structures and plate-glass windows. More general damage to power transmission and telephone lines, especially from falling trees; hundreds of lines down Several small marine craft driven aground, but all later refloated. Much disruption of highway and street traffic by fallen trees and other objects caused by wind or local wash-outs. 1 death by electrocution; 3 traffic fatalities on disrupted highways, including drowning of man, when his auto plunged into Snohomish River southwest of Puget Sound. Bulk of damage on immediate east shore of Puget Sound, from Thurston County north to Bellingham area.
Washington, southeastern and extreme east-central counties.	26–28	do			225,000	do	Much of greater part of damage occurred at Spokane, loss being about $200,000 for city and vicinity. At that place an 826-foot radio tower, Station KHQ, snapped at half height and demolished. Some 4,500 street lamps burned out by short circuits, 2,000 telephone house connections destroyed, and many thousands of intercommunication lines. Some structural damage to houses and roofs. Trees uprooted, and street and highway travel impeded. Less damage south to Pullman and Richland and west across Lincoln County, although soil erosion damage in parts of that county unestimated. (See article on River Stages and Flood in this publication.)
Idaho, northern counties	26–27	Evening 26th to morning 27th.			500,000	Winds	Unusually high winds in nearly all communities of Idaho Panhandle, but major damage concentrated in vicinity of Coeur d'Alene. Hayden Lakes County Club suffered $200,000 damage to buildings and golf course; 35 large pine trees uprooted onto fairways. Other damage in area to many fine summer homes, commercial timber (loss estimated at $100,000), automobiles, plate glass windows, and power and telephone lines. Peak of storm occurred at 4 a. m. in this area. Interruption of electric power and telephone service in Moscow, St. Maries, Wallace, Kellogg, and Priest River, and estimated small amount of damage to commercial timber near St. Maries. Heavy rains accompanied winds at several places, but little damage by rain.
Gallatin County, Mont.	27	1 a. m.–10 p. m.			1,000	do	Tops blown off haystacks, resulting in $500 loss. Roofs blown off 3 sheds. Rural telephone service out of order. In Bozeman several plate glass windows broken, Christmas decorations torn down, a trailer house upset, and shingles torn from roofs.
Pleasant Valley, Mont.	27	9–10 a. m.				do	Much damage to timber, fences, and irrigating flumes.
Geraldine, Mont.	27	9–11 a. m.				do	A hangar wrecked, crushing wings of plane; power lines blown down; several sheds toppled. Hay stored in sheds blown away.
Sheridan and Johnson Counties, Wyo.	27	Afternoon			45,000	Wind	Strong winds along east slope of Big Horn Mountains, with speed of 84 m. p. h. at Sheridan Airport and gusts to 96. Large section of a hangar roof blew off, damaging Weather Bureau wind instruments and 5 planes stored in hangar. 1 pilot slightly injured. Other damage occurred in city of Sheridan, such as damage to roofs and trees. Estimated damage in Sheridan and at Sheridan Airport $25,000. Damage at the Buffalo Airport estimated at $20,000. Many ranchers reported hay blown away.

SEVERE STORMS FOR NOVEMBER—Continued

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Arlee, Mont.	27			1		Wind	Farmer instantly killed when high wind toppled wall of a barn on him.
Great Falls, Mont.	27				1,800	do	$1,800 damage to Liberty Theatre. A wind speed of 78 m. p. h. recorded, with gusts over 90 m. p. h.
Polebridge, Mont.	27					do	Many trees blown down, blocking roads.
Hungry Horse, Mont.	27					do	Many trees uprooted, roofs torn off buildings, and signs damaged.
West Glacier, Mont.	27					do	Large trees broken and blown over, blocking many mountain roads and Government trails. Telephone and power lines out of order because of fallen trees.
Fort Benton, Mont.	27				30,000	do	Haystacks blown over; barns, roofs, and many small buildings damaged. Roof blown off a large barn. Considerable damage to power lines.
Malta, Mont.	27					do	Large plate glass window shattered, and a sign damaged.
Kings Hill, Mont.	27					Electrical	A haystack set on fire by lightning.
Seeley Lake, Mont.	27					Wind	Trees uprooted and broken; shingles torn from buildings.
Townsend, Mont.	27					do	New aluminum machine shed blown down 8 miles southeast of Townsend.
Stanford, Mont.	27				6,000	do	Damage to winter wheat and property.
Cut Bank, Mont.	27				5,000	do	Winds of 90 m. p. h., with gusts to 105 m. p. h., ripped chimneys from houses and blew down trailer houses, garages, and small buildings. Cars blown off roads.
Wolf Creek, Mont.	27					do	Man badly bruised when a wind-driven hay rack knocked him down and ran over him.
Heron, Mont.	27					Rain and wind	Heavy rain nearing cloudburst proportions followed by very high wind damaged old buildings; roofs blown off throughout valley. Electric power and telephone lines disrupted.
Madisonville, Hopkins County, Ky.	28	7-10:30 p. m.				Wind, hail, electrical, and rain.	Heavy hailstorm, with stones ranging from ¼ to 1 inch in diameter, caused damage in area of 75 sq. mi. State police radio station struck by lightning and burned out. Damage estimated at several hundred dollars.

LATE REPORT FOR MAY 1949

Mount Pleasant, Miss.	1	10:30 a. m.		0	15,000	Tornado	1 person injured; 1 home and 6 other buildings destroyed; 14 buildings damaged.

SOLAR RADIATION DATA FOR NOVEMBER 1949

Explanation of tables 1 and 2 and references to descriptions of instruments, stations, and methods of observation, and to summaries of data, are given in the MONTHLY WEATHER REVIEW, volume 72, No. 1, January 1944, page 43. A list of pyrheliometric stations is given on page 45 of that issue. An explanation of the formula used in computing the air mass values for each station listed in table 1 appears in volume 75, No. 3, March 1947, page 47.

Beginning with this issue, publication of the values of daily totals and weekly means of solar and sky radiation received on a horizontal surface at Amherst, Mass., will be included regularly in table 2. The station is located at the University of Massachusetts, and the program is under the direct supervision of Dr. H. N. Stapleton, research engineer. Coordinates of the station are: Latitude 42°24′ N.; longitude 72°32′ W.; elevation 89.6 meters m. s. l. An Eppley 180° pyrheliometer and Brown strip-chart recorder are used. Some brief but unimportant shading of the pyrheliometer is caused by a smokestack located about 200 yards to the south, and smoke therefrom produces slight pollution of an otherwise unusually clear atmosphere.

TABLE 1.—*Solar radiation intensities during November 1949*

[Gram calories per minute per square centimeter of normal surface]

Date	Sun's zenith distance									Vapor pressure	
	A. M.				0.0°	P. M.					
	78.7°	75.7°	70.7°	60.0°		60.0°	70.7°	75.7°	78.7°	7:30 a. m.[1]	1:30 p. m.[1]
MADISON, WIS.											
	Air mass										
	4.81	3.84	2.88	1.92	*0.96	1.92	2.88	3.84	4.81		
November										*Mb.*	*Mb.*
1	0.83	0.94	1.03	1.16						3.8	5.1
5	.95	1.04								2.5	5.1
7	.76	.90	1.03	1.18		1.19				5.3	8.7
8	.92	1.02	1.13	1.21		1.24				6.4	7.8
22	.94	1.03	1.13							2.3	3.7
29	.96	1.06	1.18							5.6	6.4
30	.98	1.06	1.14							4.4	3.7
Means	.91	1.01	1.11	1.18		1.22					
Departures	+.05	+.03	−.02	−.12		−.10					
LINCOLN, NEBR.											
	Air mass										
	4.77	3.81	2.86	1.91	*0.95	1.91	2.86	3.81	4.77		
November										*Mb.*	*Mb.*
2						1.24	1.05	0.92	0.83	6.4	3.2
3				1.18		1.16	1.01	.88	.82	3.3	6.1
4			1.03	1.18		1.16	.99	.86	.73	7.2	8.7
5				1.11		1.11	.94	.79	.70	4.0	6.1
7	0.79	0.92	1.05	1.20		1.21	1.01	.88	.77	6.9	7.4
15						1.27	1.12	.99	.88	3.7	3.3
16						1.24	1.09	.96	.88	3.2	3.0
21							1.14	1.01	.90	2.6	3.3
22							1.07	.92	.81	2.9	4.2
26	.83	.94	1.09							6.6	4.0
29	.88	1.01	1.14							5.3	3.8
Means	.83	.96	1.08	1.17		1.20	1.05	.91	.81		
Departures	−.06	−.05	−.08	−.18		−.12	−.11	−.11	−.09		

TABLE 1.—*Solar radiation intensities during November 1949*—Con.

Date	Sun's zenith distance									Vapor pressure	
	A. M.				0.0°	P. M.					
	78.7°	75.7°	70.7°	60.0°		60.0°	70.7°	75.7°	78.7°	7:30 a. m.[1]	1:30 p. m.[1]
TABLE MOUNTAIN, CALIF.											
	Air mass										
	3.76	3.01	2.26	1.51	*0.75	1.51	2.26	3.01	3.76		
November											
1				1.50							
2				1.51							
3				1.53							
4	1.20	1.28	1.39	1.51							
11				1.52							
12	1.23	1.30	1.41	1.53							
13				1.52							
17				1.49							
18				1.49							
22	1.15	1.23	1.34	1.47							
25				1.47							
27				1.46							
28				1.47							
29				1.48							
Means	1.19	1.27	1.38	1.50							
Departures	+.01	+.01	+.01	.00							
BOSTON, MASS.											
	Air mass										
	4.96	3.96	2.97	1.98	*0.99	1.98	2.97	3.96	4.96		
November										*Mb.*	*Mb.*
8						1.03	0.83	0.62	0.41	8.7	8.7
9								1.01	.92	5.6	5.1
14							1.15	.98	.85	13.7	8.1
15			0.30				.81	.58	.47	7.4	6.6
21			.90							4.8	5.8
30			.83				.85	.65	.59	6.1	6.1
Means			.68			1.03	.91	.77	.65		
Departures			−.20			−.09	−.07	−.08	−.09		
BLUE HILL, MASS.											
	Air mass										
	4.86	3.89	2.92	1.94	*0.97	1.94	2.92	3.89	4.86		
November										*Mb.*	*Mb.*
2							1.17	1.06	0.96	7.8	8.6
3	0.70	0.82	0.96	1.21						8.3	9.8
5	.96	1.07	1.19							5.7	5.7
6	.81	.93	1.11							4.3	4.3
8						1.11	.86	.72	.57	8.6	8.5
9	.95	1.06	1.17			1.34	1.24	1.12	1.01	6.0	5.0
10	.32	.44	.65	.99			.89	.73	62	7.7	10.4
12						1.18	1.08			5.3	4.2
14							1.19	1.04	.93	13.8	7.5
15	.82	.93	1.06	1.27			1.13	.97	.84	6.3	6.3
16	.72						1.01	.84	.82	7.4	6.6
21			1.06						.82	4.7	5.1
22								1.07	.96	3.0	2.5
26		.83				1.39	1.25	1.12	1.01	2.5	1.9
30	.76	.89	1.03				.96		.79	5.8	5.7
Means	.76	.87	1.03	1.16		1.26	1.08	.96	.85		
Departures	−.14	−.13	−.08	−.11		.00	−.03	−.02	−.01		
RATIO, BOSTON-BLUE HILL ON COMPARABLE DATES											
			0.65			0.93	0.88	0.83	0.78		

*Extrapolated.
[1] 75th Meridian time.

TABLE 2.—*Daily totals and weekly means of solar radiation (direct+diffuse) received on a horizontal surface during November 1949*

[Gram-calories per square centimeter]

Date	Honolulu, T. H.	Pearl Harbor, T. H.	La Jolla, Calif.	Riverside, Calif.	Nashville, Tenn.	Fresno, Calif.	Davis, Calif.	Washington, D. C.	Columbia, Mo.	Soda Springs, Calif.	Seabrook, N. J.	Grand Lake, Colo.	Salt Lake City, Utah	New York, N. Y.	State College, Pa.	Lincoln, Nebr.	Newport, R. I.	Put-in-Bay, Ohio	East Wareham, Mass.	Blue Hill, Mass.	Boston, Mass.	Amherst, Mass.	Lynn, Mass.	Ithaca, N. Y.	Twin Falls, Idaho	East Lansing, Mich.	Madison, Wis.	Portland, Maine	Toronto, Canada	Caribou, Maine	Summit, Mont.	Fairbanks, Alaska
Oct. 29	535	490	350	367	171	344	330	86	.....	371	152	56	194	.....	215	329	246	321	200	240	228	.....	224	.....	290	254	306	217	209	258	123	.....
Oct. 30	546	387	358	362	42	357	356	51	.....	390	58	410	328	.....	95	258	198	260	232	177	159	.....	178	.....	273	176	122	142	181	250	254	.....
Oct. 31	441	266	361	364	34	367	349	188	.....	382	166	385	333	146	177	353	94	182	63	49	51	.....	53	.....	323	91	329	76	122	34	223	.....
Nov. 1	346	320	366	364	366	349	350	101	.....	388	83	369	306	123	316	326	94	337	124	146	133	202	153	.....	306	265	278	215	223	208	255	.....
Nov. 2	570	518	368	360	358	346	334	336	.....	379	319	373	298	254	313	330	174	169	93	215	210	272	219	.....	306	88	70	259	83	145	246	.....
Nov. 3	301	359	342	354	251	347	332	100	.....	360	232	373	300	175	36	329	133	22	144	198	153	235	168	.....	302	31	197	219	83	116	253	.....
Nov. 4	479	411	361	350	368	352	332	245	.....	(376)	264	370	287	289	100	314	265	32	171	87	99	79	106	.....	293	63	131	47	112	11	230	.....
Means	460	393	358	360	227	352	340	158	.....	378	182	334	292	197	179	320	172	189	147	159	148	197	157	.....	299	138	205	168	145	146	226	.....
Departures	−6	−20	+19	+46	+11	+27	+49	−78	.....	+44	.....	+6	+8	−6	+1	+89	−40	−4	−51	−48	−13	.....	.....	.....	+86	00	+23	.....	+11	.....	+41	.....
Nov. 5	356	319	343	341	341	333	218	78	.....	342	171	362	279	104	78	314	227	260	192	172	124	114	131	.....	290	252	275	108	188	119	230	.....
Nov. 6	440	395	337	337	348	299	176	221	.....	263	306	359	282	302	144	293	290	121	269	189	150	150	186	.....	279	153	278	186	34	153	219	.....
Nov. 7	488	438	300	313	361	181	152	295	.....	60	246	351	245	72	272	314	102	300	84	72	54	58	65	.....	106	196	272	78	97	125	(226)	.....
Nov. 8	504	437	265	195	349	179	157	303	.....	75	291	339	240	256	299	275	266	297	261	259	225	217	236	.....	95	215	271	223	214	41	31	.....
Nov. 9	452	455	196	133	336	60	.....	283	.....	24	248	167	81	299	252	285	292	279	263	288	256	268	269	.....	45	210	222	273	210	220	90	.....
Nov. 10	554	576	77	84	346	302	203	252	.....	170	253	127	29	219	265	228	254	202	251	249	198	166	200	.....	70	153	151	177	83	142	72	.....
Nov. 11	169	195	324	321	284	333	276	239	.....	375	220	117	281	196	231	248	125	195	129	111	102	168	134	.....	228	86	36	61	21	233	64	.....
Means	423	402	263	246	338	241	197	239	.....	187	248	260	205	207	220	280	222	236	207	192	158	163	174	.....	159	181	215	158	121	148	133	.....
Departure	−12	+4	−43	−53	+130	−50	−63	+18	.....	−81	.....	−26	−35	+27	+68	+56	+24	+72	+36	+11	+20	.....	.....	.....	−41	+73	+55	.....	+15	.....	−13	.....
Nov. 12	482	432	330	343	252	309	340	196	.....	355	50	313	280	27	136	82	115	201	170	241	226	112	243	.....	256	30	36	274	49	175	17	.....
Nov. 13	387	386	324	342	97	322	294	137	.....	334	57	329	288	21	44	290	72	50	77	50	27	16	34	.....	254	28	235	30	31	181	53	.....
Nov. 14	386	407	329	316	294	200	238	293	.....	286	238	303	239	215	169	293	240	165	223	220	220	201	162	.....	201	34	50	151	45	43	39	.....
Nov. 15	471	476	321	324	320	307	273	264	.....	338	220	237	258	192	212	280	257	112	253	251	190	232	202	.....	249	77	56	236	46	117	133	.....
Nov. 16	440	364	325	316	282	277	243	155	.....	279	187	276	239	221	69	208	251	116	263	196	157	216	156	.....	228	33	122	101	84	178	161	.....
Nov. 17	514	387	311	314	200	290	235	113	.....	(310)	188	303	244	173	63	244	54	74	20	36	27	113	37	.....	236	68	62	73	83	67	149	.....
Nov. 18	365	329	311	299	190	293	295	136	.....	330	166	274	241	49	119	255	112	136	84	153	143	130	160	.....	248	109	118	207	86	135	124	.....
Means	435	397	322	322	234	294	274	185	.....	319	158	291	256	128	116	236	158	122	156	164	142	146	142	.....	239	54	97	153	61	128	90	.....
Departure	−13	−17	+34	+43	+22	+46	+60	−17	.....	+39	.....	+13	+25	−25	−49	+28	−23	− 28	−17	+1	+6	.....	.....	.....	+74	−51	−54	.....	−43	.....	−15	.....
Nov. 19	472	371	265	298	304	280	306	163	.....	325	219	290	247	150	92	251	262	54	253	245	210	186	204	.....	250	36	151	198	25	160	165	.....
Nov. 20	428	446	280	194	294	271	283	220	.....	(303)	187	302	245	.....	70	239	88	94	96	82	80	41	88	.....	243	72	78	49	77	68	(194)	.....
Nov. 21	497	491	134	168	142	245	271	264	.....	(305)	152	306	235	181	83	250	147	103	127	167	140	103	150	.....	240	129	112	104	209	108	(182)	.....
Nov. 22	518	483	117	280	313	245	264	263	.....	294	243	287	209	270	243	260	140	180	184	147	129	212	157	.....	231	150	206	207	184	113	(91)	.....
Nov. 23	521	486	202	272	285	229	221	249	.....	244	246	127	154	186	212	196	125	89	90	200	176	135	167	.....	55	92	238	115	95	105	42	.....
Nov. 24	524	458	287	261	54	222	276	192	.....	(292)	209	291	193	.....	77	226	228	32	263	221	188	173	182	.....	153	21	34	148	36	189	58	.....
Nov. 25	542	480	154	247	82	242	240	.....	.....	298	88	278	173	.....	10	242	17	198	25	30	20	.....	26	.....	151	113	96	45	201	19	22	.....
Means	500	459	206	246	211	248	266	225	.....	294	192	269	208	197	112	238	144	107	148	156	135	142	139	.....	189	88	131	124	118	109	108	.....
Departure	+25	+25	−75	−28	+29	+13	+36	+40	.....	+3	.....	+6	−8	+54	−18	+43	−11	−10	+8	+10	+31	.....	.....	.....	+32	00	+2	.....	+32	.....	+8	.....
Nov. 26	508	492	146	266	304	209	138	.....	.....	268	276	201	239	.....	268	242	243	168	172	231	178	239	182	.....	138	89	63	163	205	86	87	.....
Nov. 27	459	422	139	265	250	187	243	109	.....	177	115	164	227	.....	32	178	55	37	94	66	64	74	71	.....	160	69	223	126	54	145	42	.....
Nov. 28	503	477	212	168	117	188	87	139	.....	283	202	124	166	.....	118	183	54	83	31	26	27	.....	34	.....	104	80	101	151	75	181	41	.....
Nov. 29	412	388	192	266	214	222	250	125	.....	282	46	249	221	.....	147	252	12	82	52	11	18	13	9	.....	220	117	225	20	32	87	106	.....
Nov. 30	478	445	193	270	283	189	216	239	.....	245	214	278	120	.....	188	247	225	190	220	214	185	178	170	.....	184	97	139	170	71	86	34	.....
Dec. 1	449	321	226	276	254	99	247	240	.....	285	234	277	199	.....	110	229	164	151	148	186	147	159	144	.....	199	99	80	192	115	182	98	.....
Dec. 2	435	408	142	282	287	70	136	90	.....	(256)	46	278	188	.....	49	210	34	246	63	70	37	65	67	.....	113	227	138	92	77	188	(38)	.....
Means	464	422	178	256	244	166	188	157	.....	256	162	224	194	.....	130	220	112	137	111	115	94	121	97	.....	160	111	138	130	90	136	94	.....
Departure	−3	−5	−77	+2	+76	−37	+1	−9	.....	+17	.....	−2	+8	.....	00	+39	−41	+23	−25	−32	−1	.....	.....	.....	+15	+21	+10	.....	−10	.....	00	.....

ACCUMULATED DEPARTURES ON DECEMBER 2, 1949

	+329	+364	−12110	.....	+8491	+10948	.....	−2114	.....	+1393	.....	.....	−896	.....	+8036	−2016	+5803	+10899	+3609	+6685	+12131	.....	.....	.....	+5341	−3276	+9688	.....	+364	.....	+581	.....

NOTE.—Values in parentheses are interpolated.

TABLE 3.—*Daily totals and weekly means of solar and sky radiation plus the radiation reflected from the ground, as received on a vertical surface facing south at Blue Hill, Mass., during November 1949*

Date	29	30	31	1	2	3	4	Mean	5	6	7	8	9	10	11	Mean	12	13	14	15	16	17	18	Mean
Gm cal cm^{-2}	299	152	34	108	293	262	76	175	228	214	38	436	508	415	121	280	378	20	370	471	326	20	171	251
Date	19	20	21	22	23	24	25	Mean	26	27	28	29	30	1	2	Mean								
Gm cal cm^{-2}	462	63	285	206	339	344	10	244		31	15	5	464	347	42	151								

TABLE 4.—*Daily totals and weekly means of solar and sky radiation plus the radiation reflected from the ground, as received on a vertical surface facing north at Blue Hill, Mass., during November 1949*

Date	29	30	31	1	2	3	4	Mean	5	6	7	8	9	10	11	Mean	12	13	14	15	16	17	18	Mean
Gm cal cm^{-2}	50	53	18	50	46	44	30	42	38	47	23	43	34	35	22	34	29	16	38	36	44	13	41	31
Date	19	20	21	22	23	24	25	Mean	26	27	28	29	30	1	2	Mean								
Gm cal cm^{-2}	40	30	35	42	35	44	8	33	41	26	14	2	29	34	26	24								

U. S. GOVERNMENT PRINTING OFFICE: 1950

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, November 1949

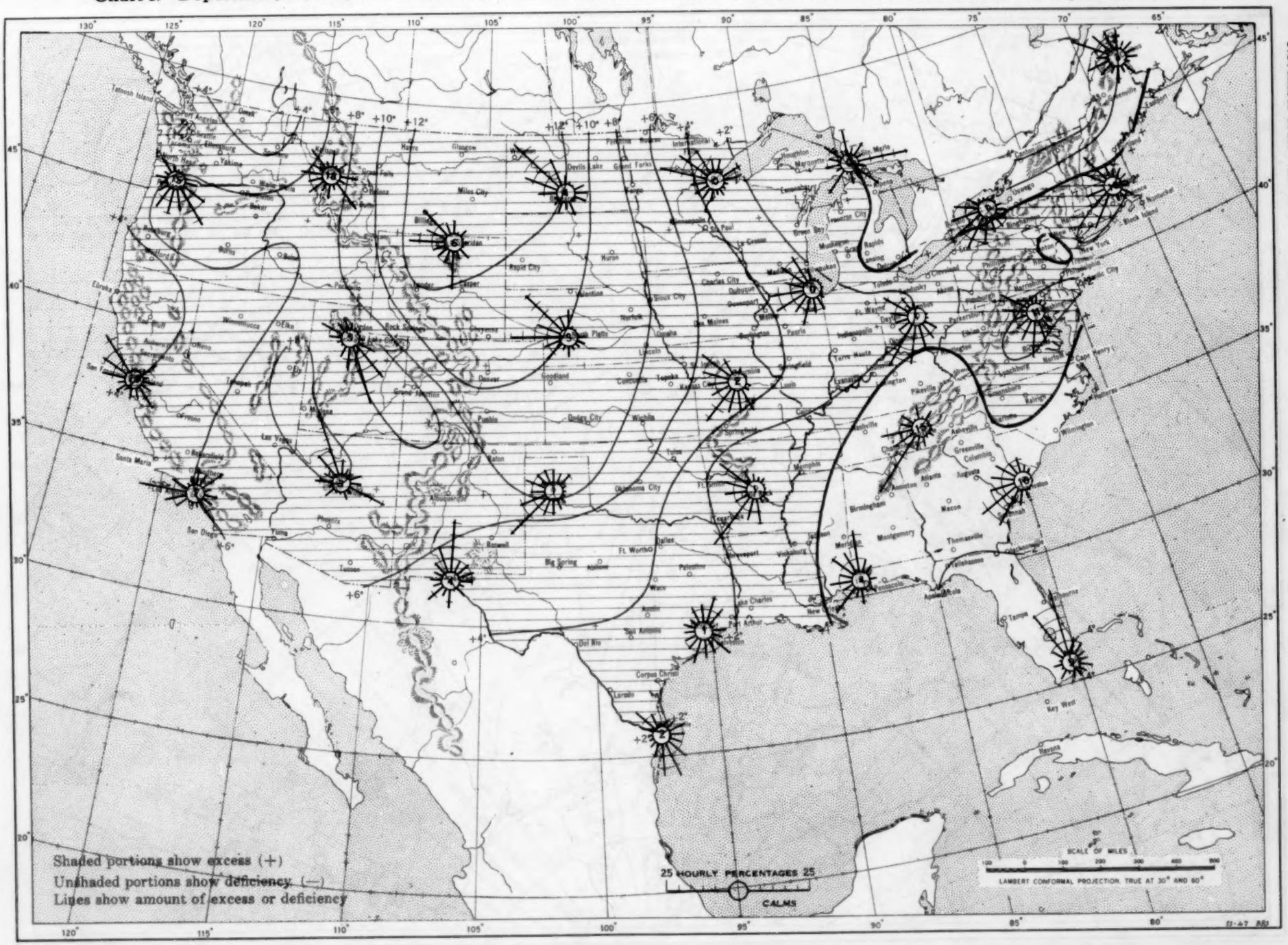
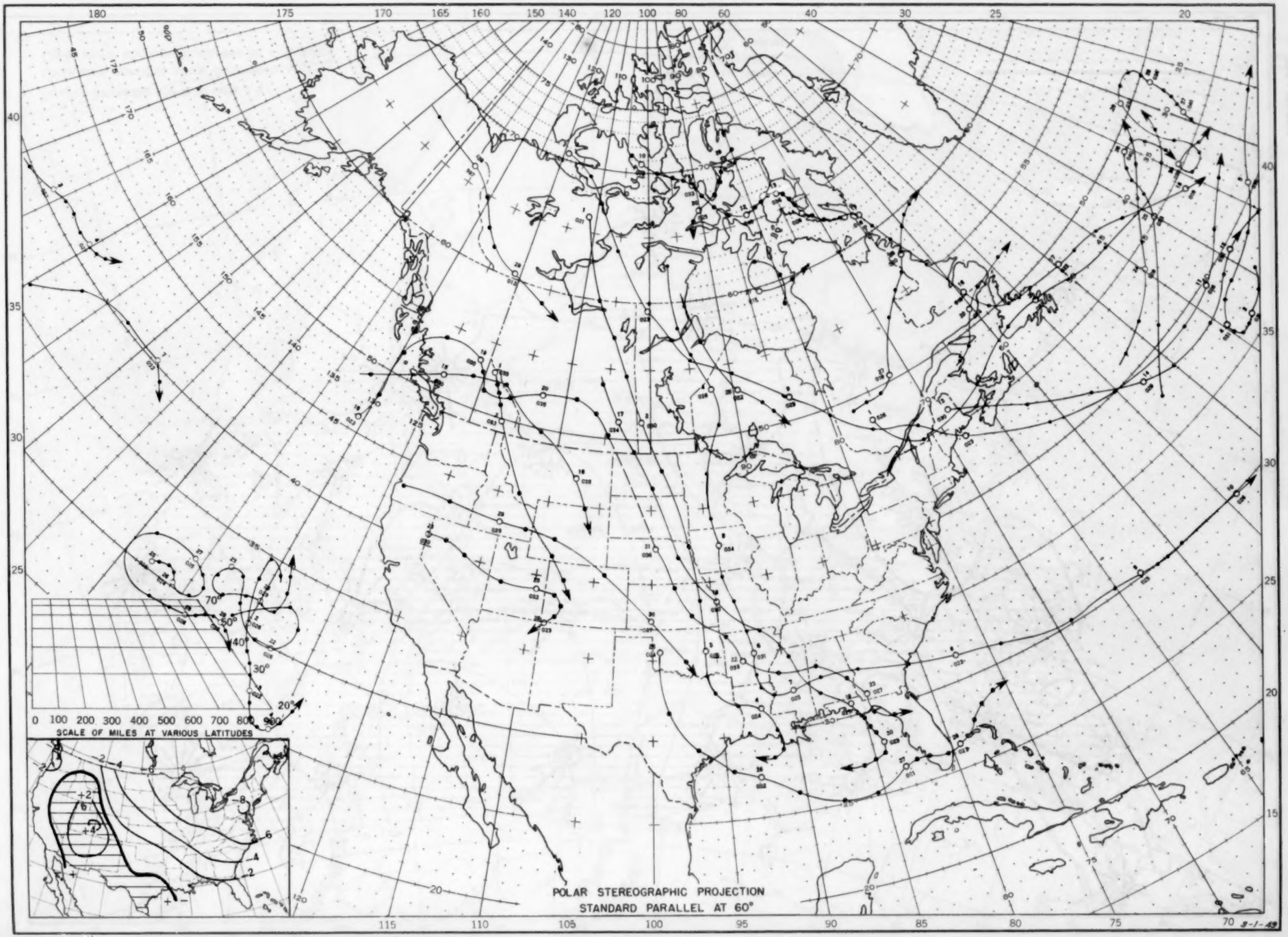
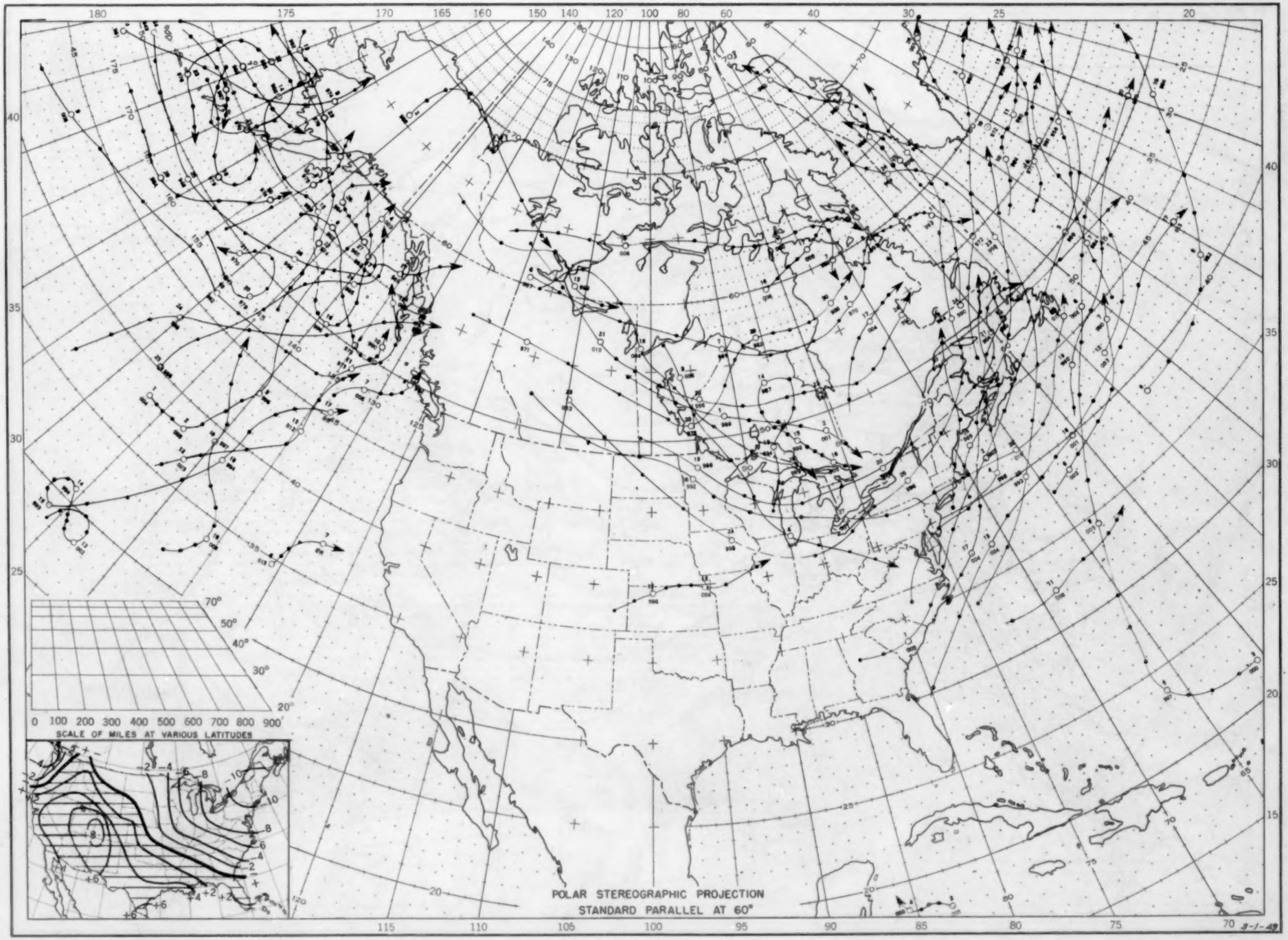

Shaded portions show excess (+)
Unshaded portions show deficiency (—)
Lines show amount of excess or deficiency
25 HOURLY PERCENTAGES 25
CALMS
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION TRUE AT 30° AND 60°

Chart II. Tracks of Centers of Anticyclones, November 1949. (Inset) Departure of Monthly Mean Pressure from Normal


SCALE OF MILES AT VARIOUS LATITUDES
0 100 200 300 400 500 600 700 800 900
POLAR STEREOGRAPHIC PROJECTION
STANDARD PARALLEL AT 60°

Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time). Dots indicate intervening 6-hourly positions. Figure above circle indicates date, and figure below, pressure to nearest millibar. Only those centers which could be identified for 24 hours or more are included.

Chart III. Tracks of Centers of Cyclones, November 1949. (Inset) Change in Mean Pressure from Preceding Month


70° 50° 40° 30° 20°
0 100 200 300 400 500 600 700 800 900
SCALE OF MILES AT VARIOUS LATITUDES
POLAR STEREOGRAPHIC PROJECTION
STANDARD PARALLEL AT 60°

Circle indicates position of cyclone at 7:30 a. m. (75th meridian time) Dots indicate intervening 6-hourly positions. Figure above circle indicates date, and figure below, pressure to nearest millibar. Only those centers which could be identified for 24 hours or more are included.

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, November 1949

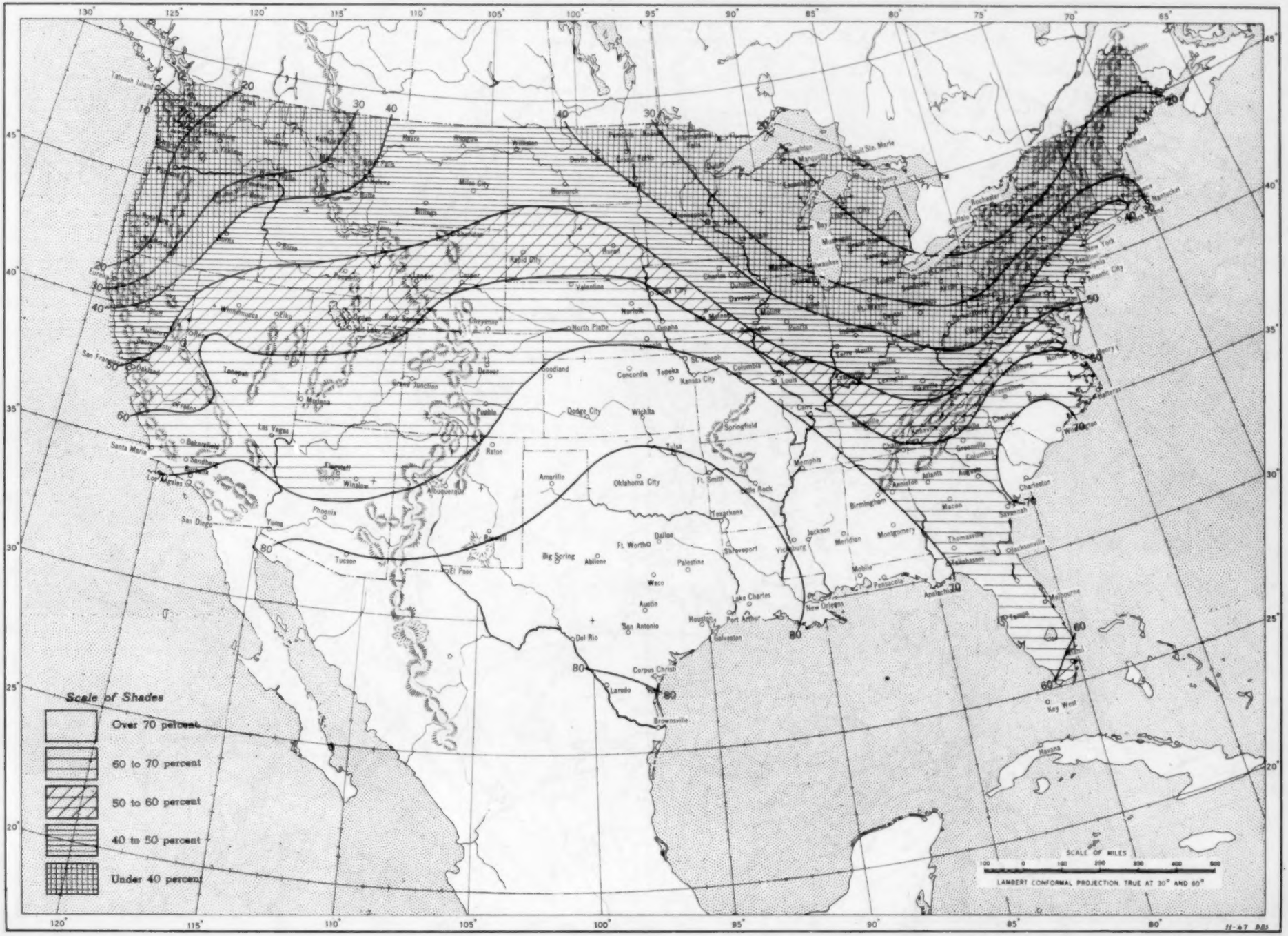


Chart V. Total Precipitation, Inches, November 1949. (Inset) Departure of Precipitation from Normal

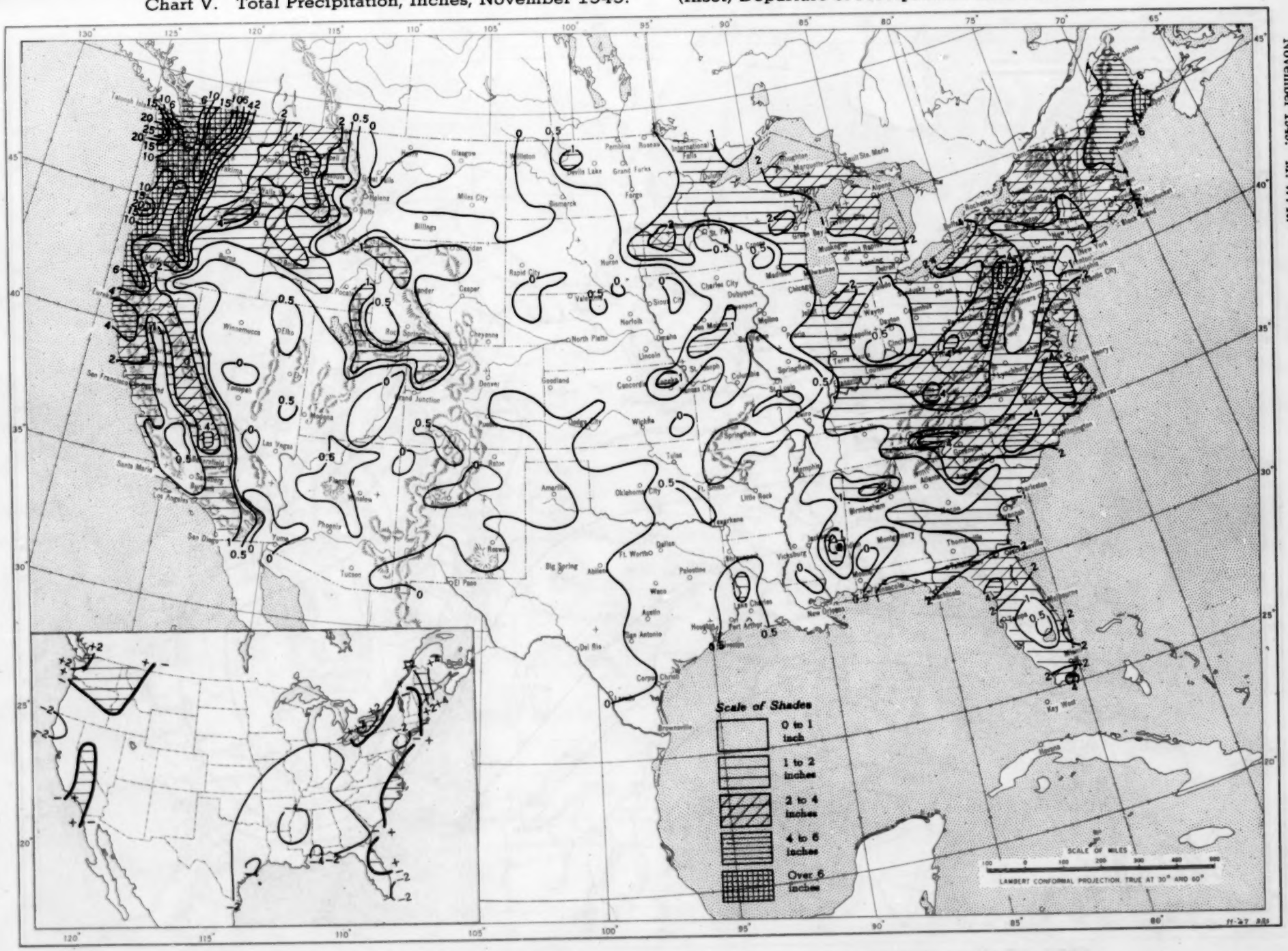

Scale of Shades
0 to 1 inch
1 to 2 inches
2 to 4 inches
4 to 6 inches
Over 6 inches
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION TRUE AT 30° AND 60°

Chart VI. Mean Isobars (mb.) at Sea Level and Mean Isotherms (°F.) at Surface., November 1949

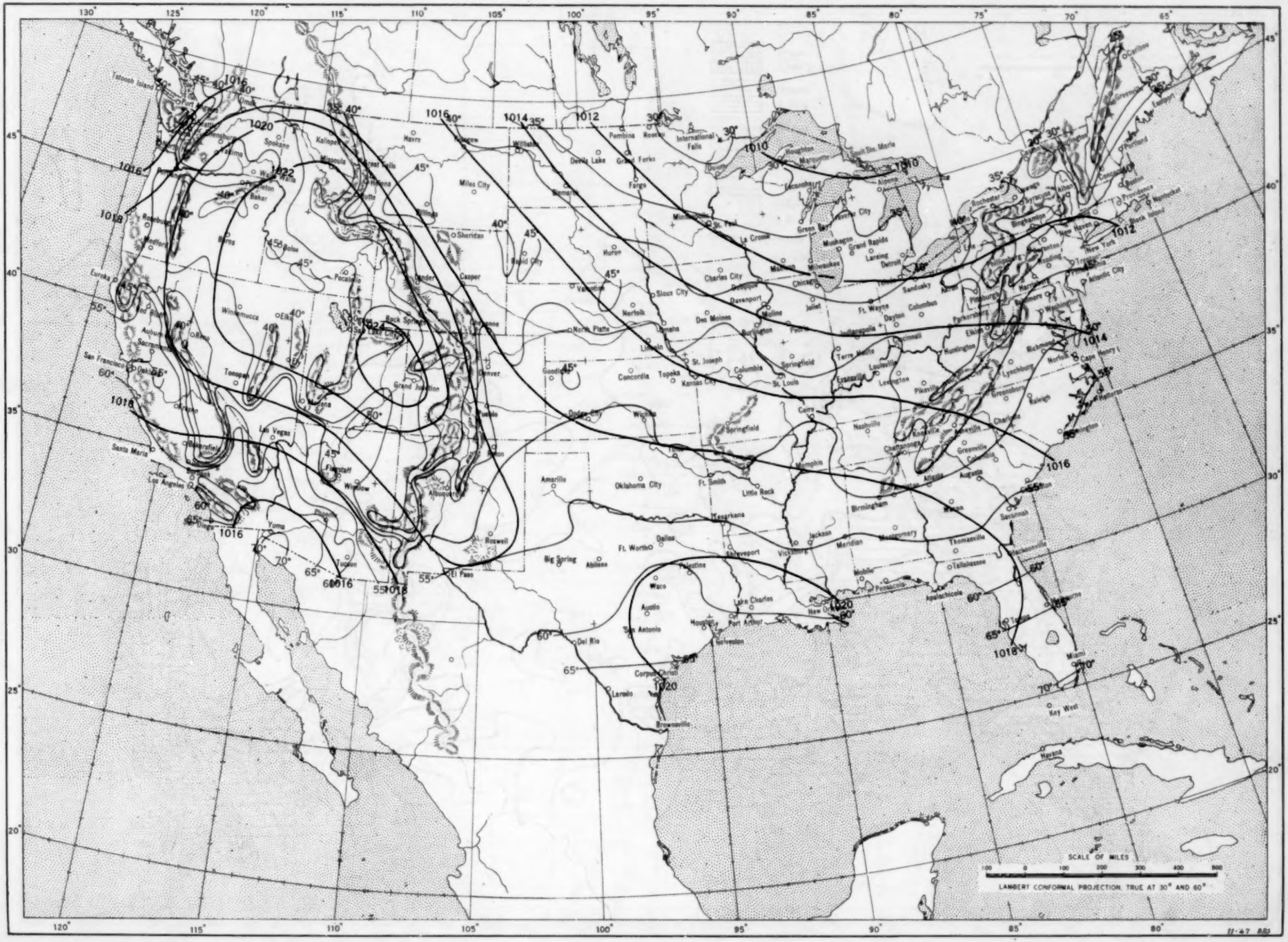


Chart VII. Total Snowfall, Inches, November 1949.

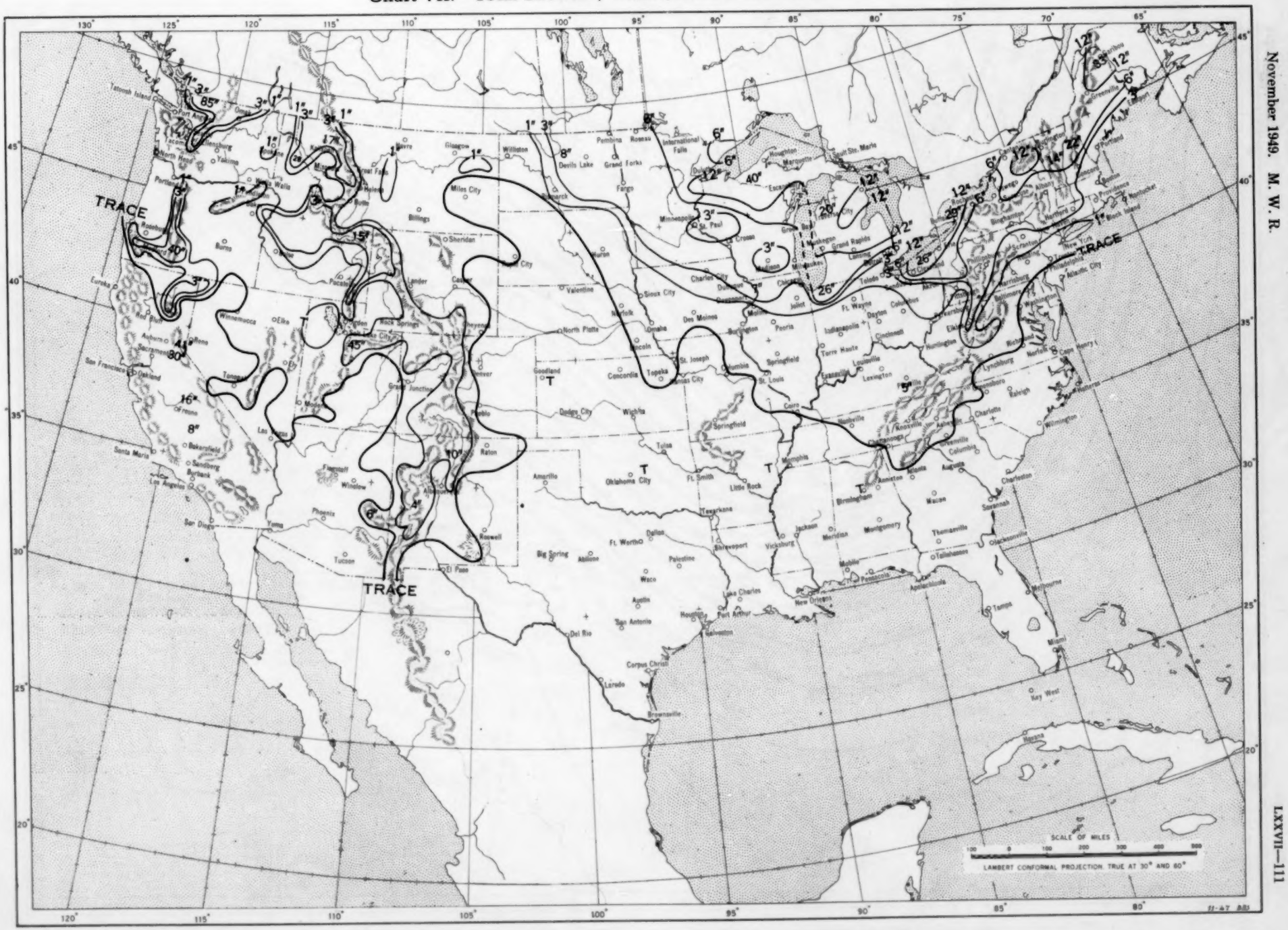
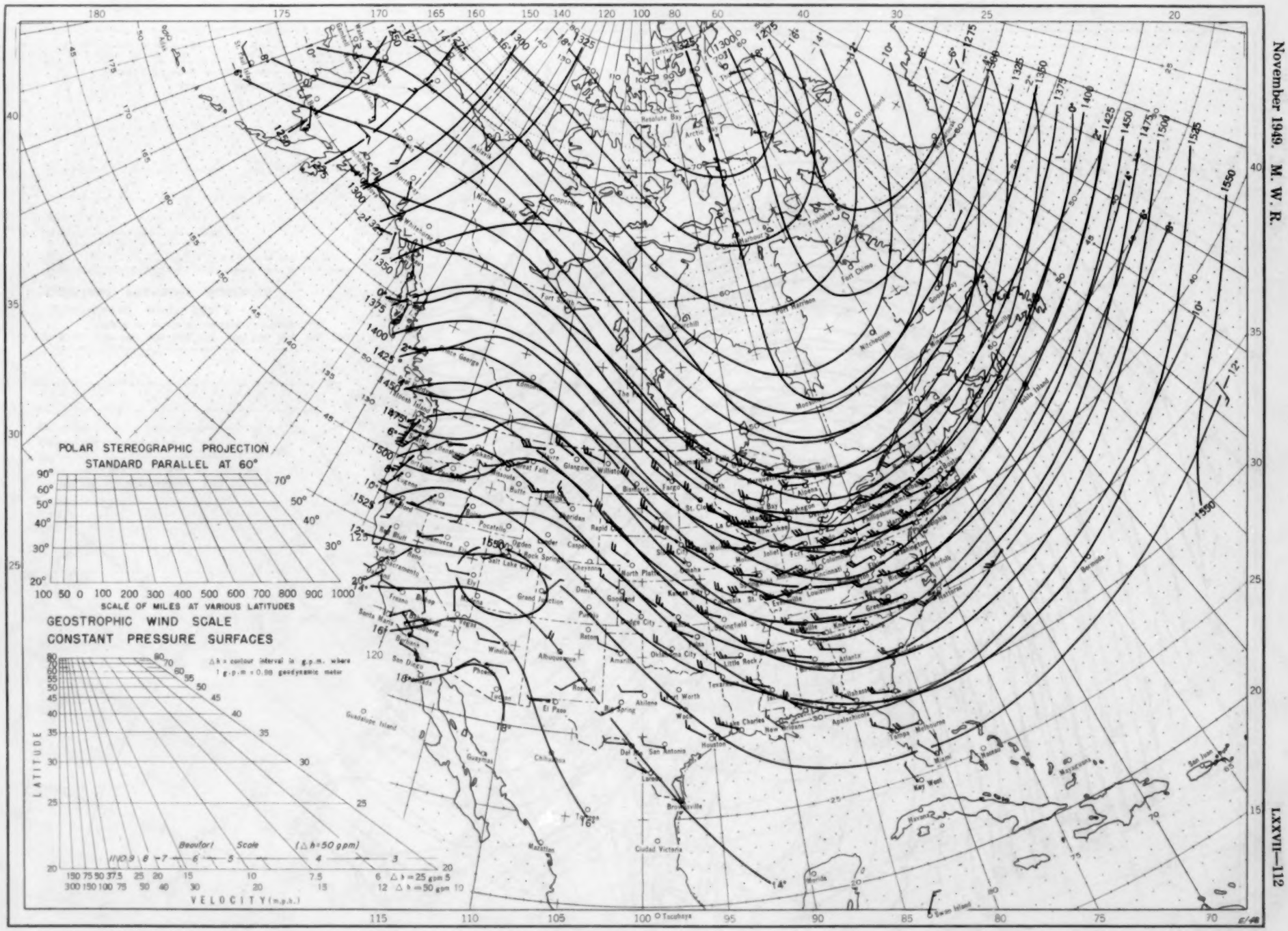


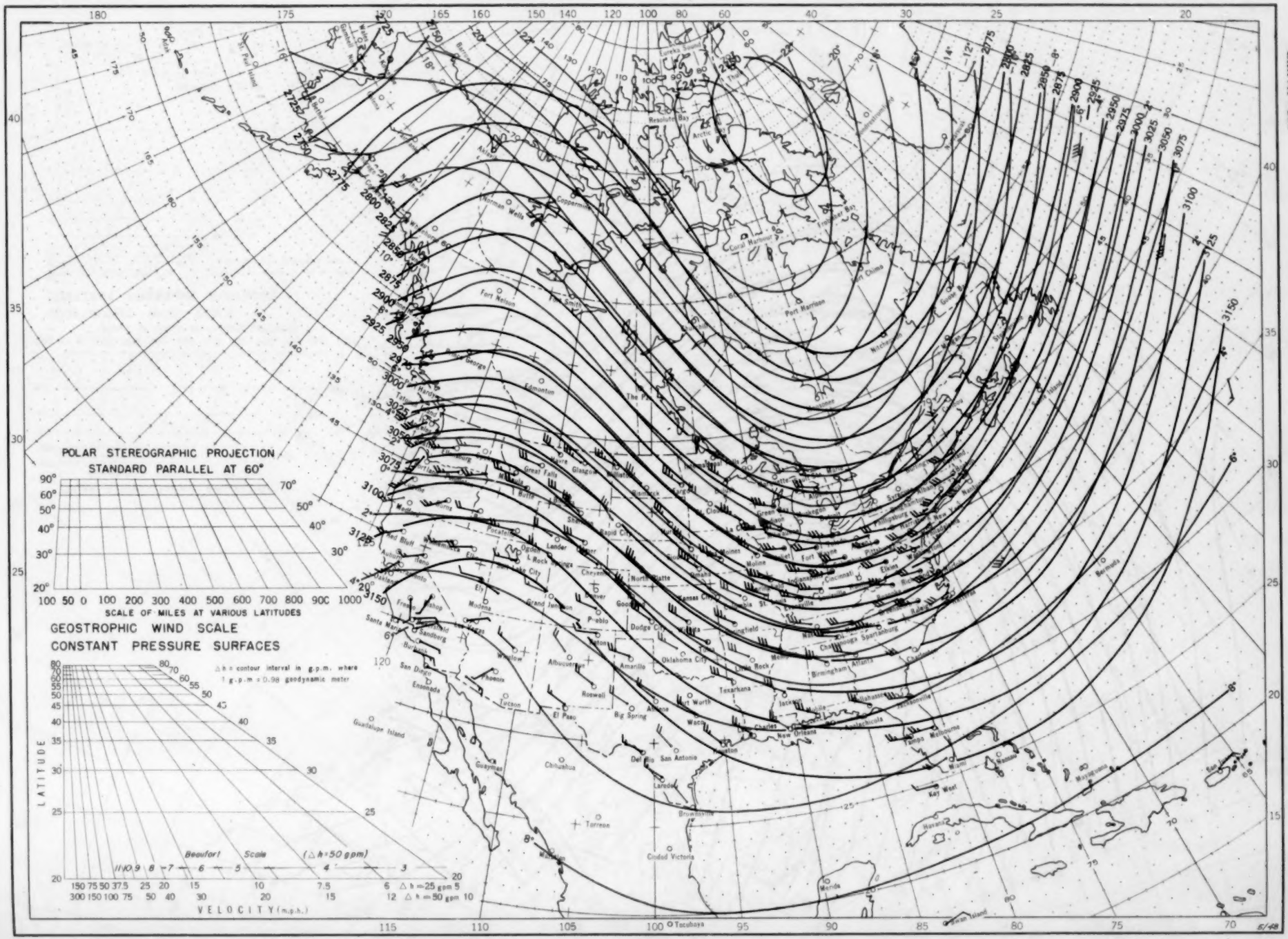
Chart VIII, November 1949. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 850-millibar Pressure Surface, and Resultant Winds at 1,500 Meters (m. s. l.)

Chart VIII, November 1949. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 850-millibar Pressure Surface, and Resultant Winds at 1,500 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

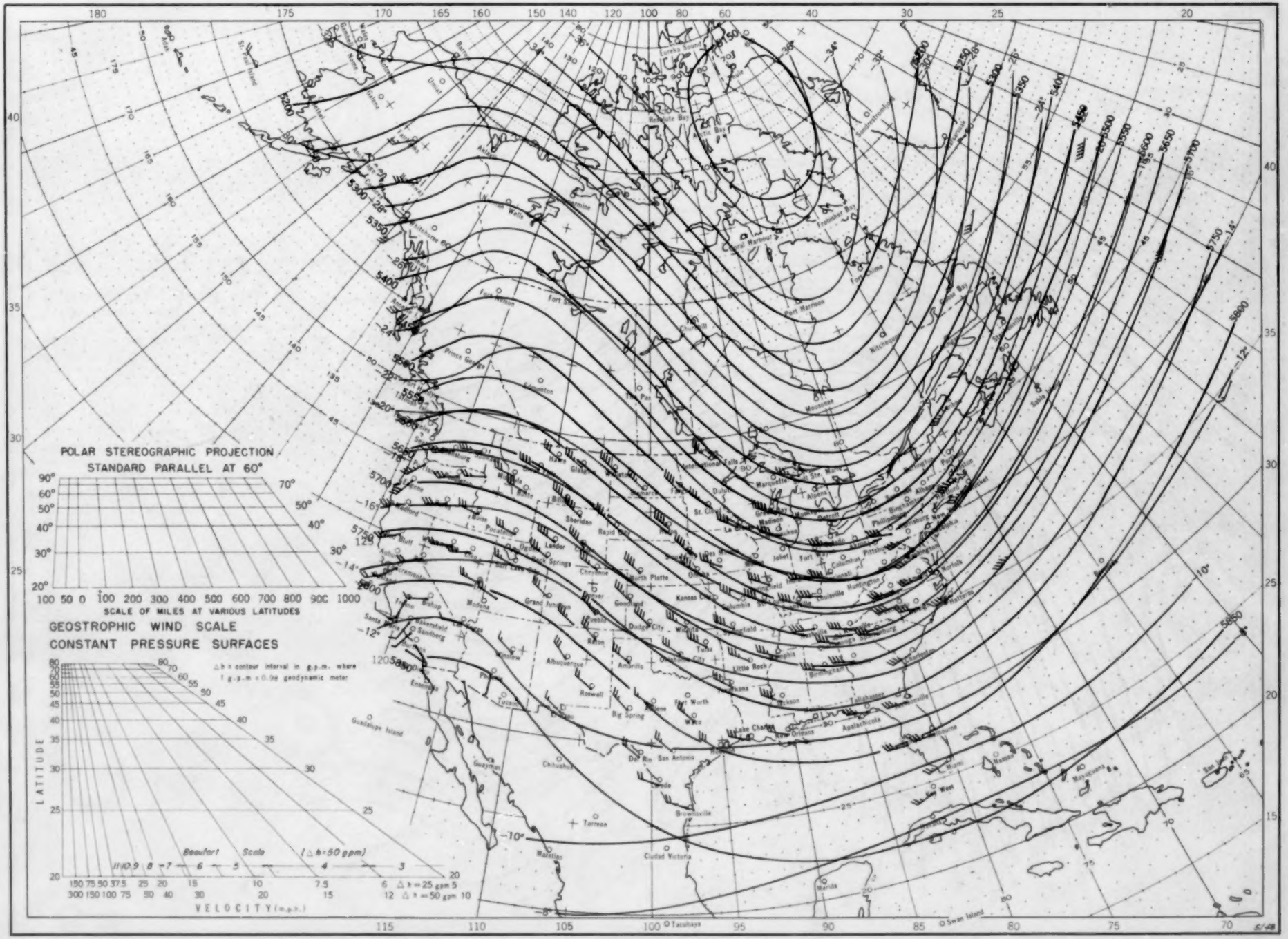
Chart IX, November 1949. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 700-millibar Pressure Surface, and Resultant Winds at 3,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

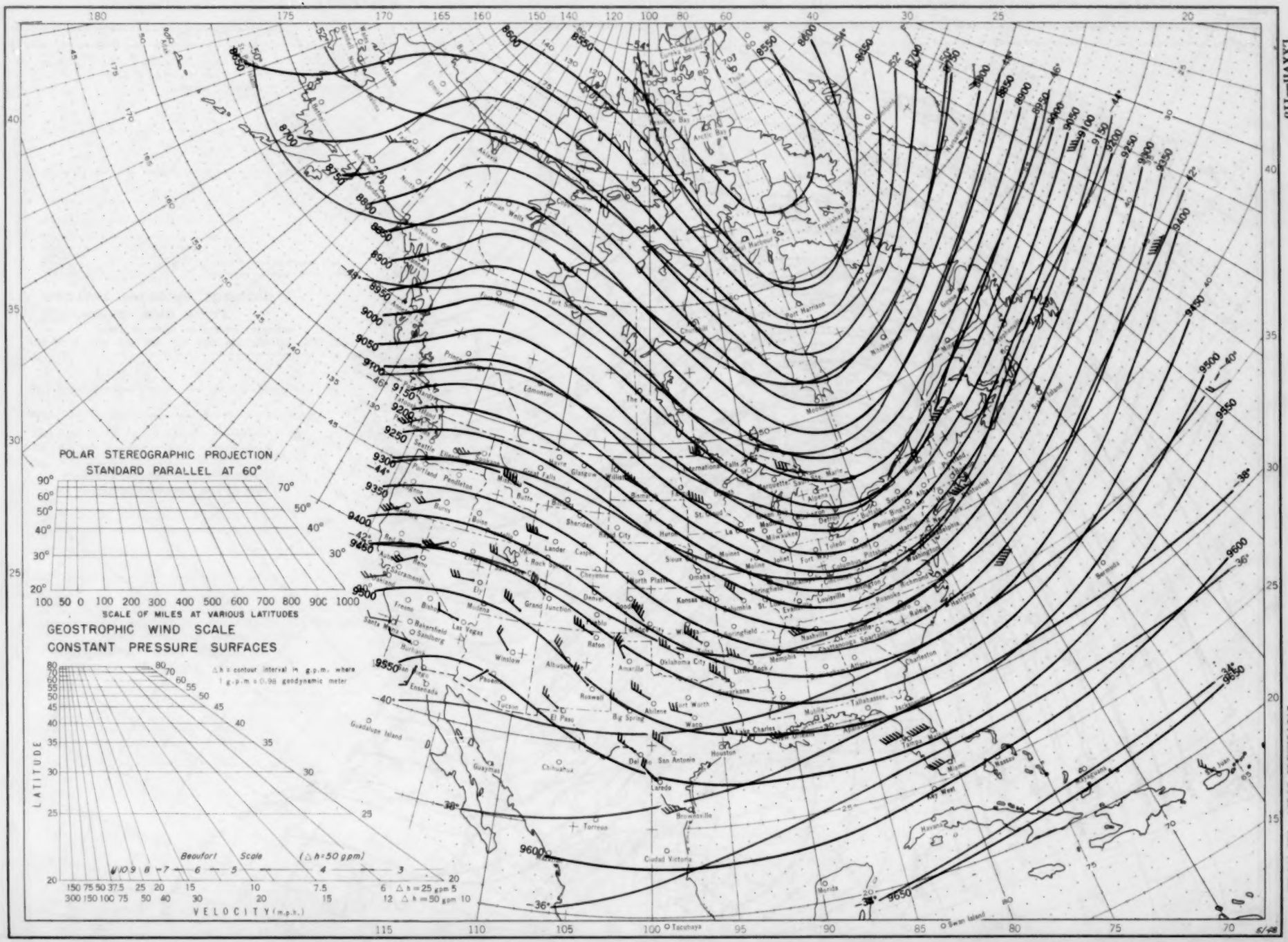
those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart X, November 1949. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 500-millibar Pressure Surface, and Resultant Winds at 5,000 Meters (m. s. l.)


POLAR STEREOGRAPHIC PROJECTION
STANDARD PARALLEL AT 60°
SCALE OF MILES AT VARIOUS LATITUDES
GEOSTROPHIC WIND SCALE
CONSTANT PRESSURE SURFACES
LATITUDE
VELOCITY (m.p.h.)
Beaufort Scale
Δh = contour interval in g.p.m. where 1 g.p.m. = 0.98 geodynamic meter

Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.;

Isotherms in Degrees Centigrade for the 300-millibar Pressure Surface, and Resultant Winds at 10,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.